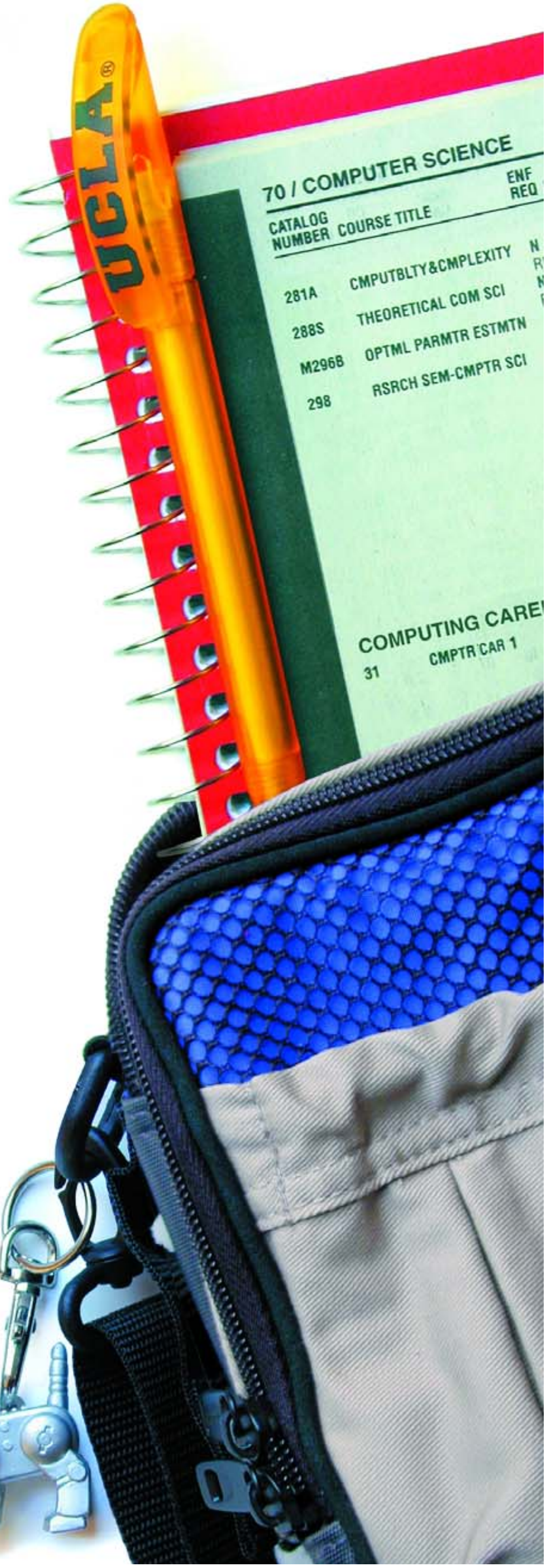
CHAPTER 16

Computer Careers and Certification

College life has been much more than you anticipated … more demanding, more challenging, more rewarding, and more fun! It took a few weeks to coordinate all your classes and activities, but now with your first semester well under way, you feel quite comfortable with the school atmosphere. Classes are intense, but all the hard work and efforts are paying off. Your grades so far have been good. Best of all, you have made many new friends. In fact, you just joined a few of them in the school cafeteria for lunch.

The group's conversation centers on registration, which starts tomorrow. You, and most of your friends, are in the General Studies program. The dilemma now is selecting a major. That decision will determine which classes you take next semester. You have not made an appointment with an advisor yet because you have no idea what career path you plan to take.

One friend mentions that some departments offer one-credit courses that explore careers in a field of study. He is interested in computers, so he plans to sign up for the Computing Careers course next semester. You like working with computers. Immediately, you add the Computing Careers course to your schedule.

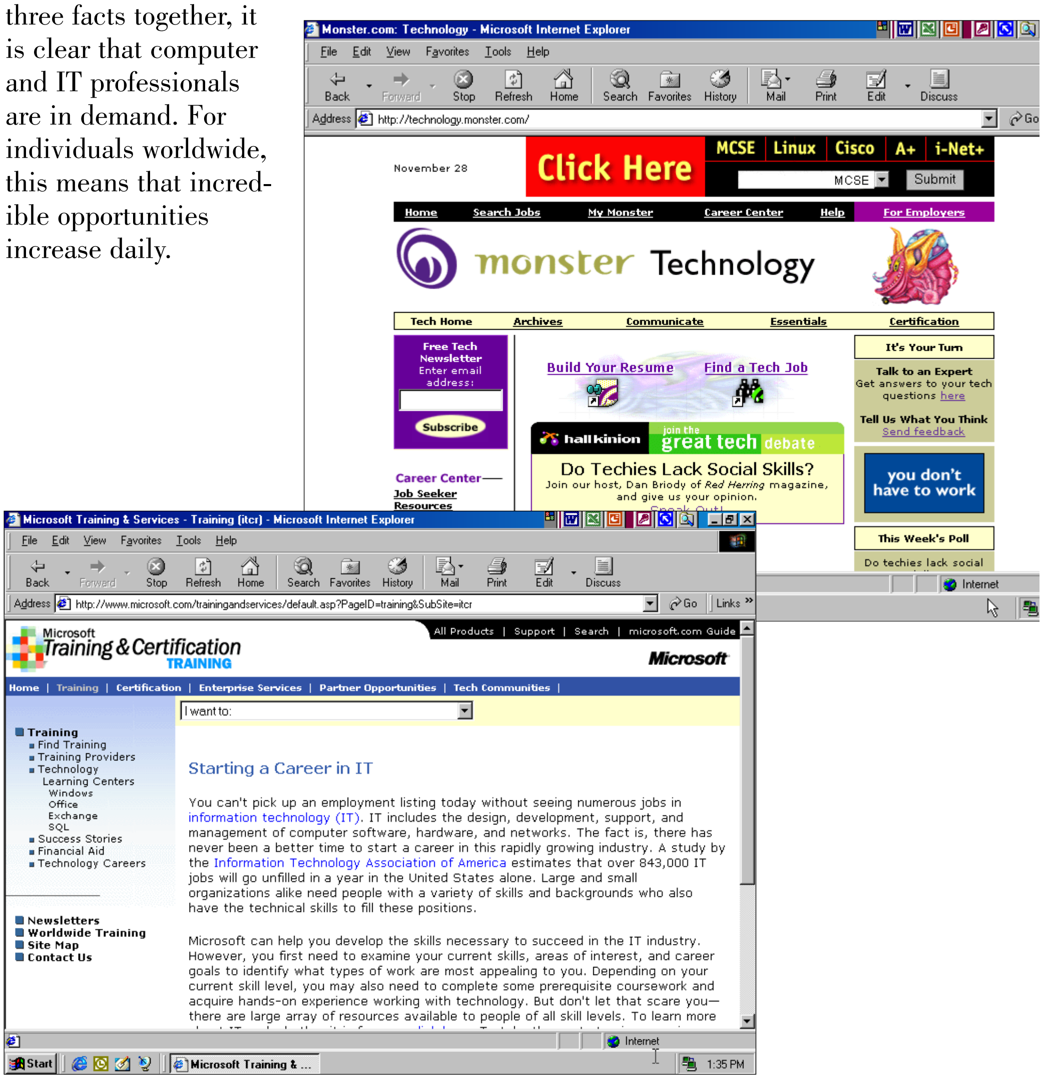


CAREERS IN THE COMPUTER INDUSTRY

In today's technology-rich world, a great demand for computer and information technology (IT) professionals exists and continues to grow. In fact, the U.S. Department of Labor's Bureau of Labor Statistics recently reported that by the year 2006, American businesses and schools will require more than 5.6 million new systems analysts, computer scientists, engineers, and programmers. Nearly 20 percent of the U.S. information technology careers — or 800,000 jobs — are open today. Currently, however, fewer than three percent of college freshmen are majoring in a computer-related field. When you consider these three facts together, it is clear that computer and IT professionals are in demand. For individuals worldwide, this means that incredible opportunities increase daily.

As presented in the Career Corner feature in each chapter of this book, the computer and IT industry offers many rewarding careers, which can require a unique combination of hands-on skills, creative problem solving, and an understanding of business needs. This chapter discusses the careers available, preparing for a job, and planning for career development in the computer and IT industry.

With annual sales of nearly $400 billion, the computer industry is one of the larger worldwide industries. Approximately one-half of this $400 billion total is related to equipment sales; the other half comes from software and service sales.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Free Tech Newsletter
Enter email address:
Subscribe
Build Your Resume
Find a Tech Job
hall kinion
join the great tech debate
It's Your Turn
Talk to an Expert
Get answers to your tech questions here
Tell Us What You Think
Send feedback
you don't have to work
This Week's Poll
Do techies lack social
Career Center
Job Seeker
Resources
Internet
Microsoft Training & Services - Training (itcr) - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://www.microsoft.com/trainingandservices/default.asp?PageID=training&SubSite=itcr
Go Links
All Products | Support | Search | microsoft.com Guide
Microsoft Training & Certification TRAINING
Microsoft
Home | Training | Certification | Enterprise Services | Partner Opportunities | Tech Communities |
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Training Providers
Technology
Learning Centers
Windows
Office
Exchange
SQL
Success Stories
Financial Aid
Technology Careers
Newsletters
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Site Map
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Do Techies Lack Social Skills?
Join our host, Dan Briody of *Red Herring* magazine, and give us your opinion.

Starting a Career in IT

You can't pick up an employment listing today without seeing numerous jobs in information technology (IT). IT includes the design, development, support, and management of computer software, hardware, and networks. The fact is, there has never been a better time to start a career in this rapidly growing industry. A study by the Information Technology Association of America estimates that over 843,000 IT jobs will go unfilled in a year in the United States alone. Large and small organizations alike need people with a variety of skills and backgrounds who also have the technical skills to fill these positions.

Microsoft can help you develop the skills necessary to succeed in the IT industry. However, you first need to examine your current skills, areas of interest, and career goals to identify what types of work are most appealing to you. Depending on your current skill level, you may also need to complete some prerequisite coursework and acquire hands-on experience working with technology. But don't let that scare you—there are large array of resources available to people of all skill levels. To learn more

Figure 16-1 Information on computer-related jobs is available on many Web sites on the World Wide Web.

OBJECTIVES

After completing this chapter, you will be able to:

- Describe career opportunities in the computer industry
- Discuss how to prepare for a career in the computer industry
- Define the term certification
- Describe types of IT certification
- List the benefits of certification
- Explain considerations for choosing a certification
- Describe methods of preparation for certification
- Discuss features of certification examinations and recertification requirements
- Understand how to keep informed about changes in certification

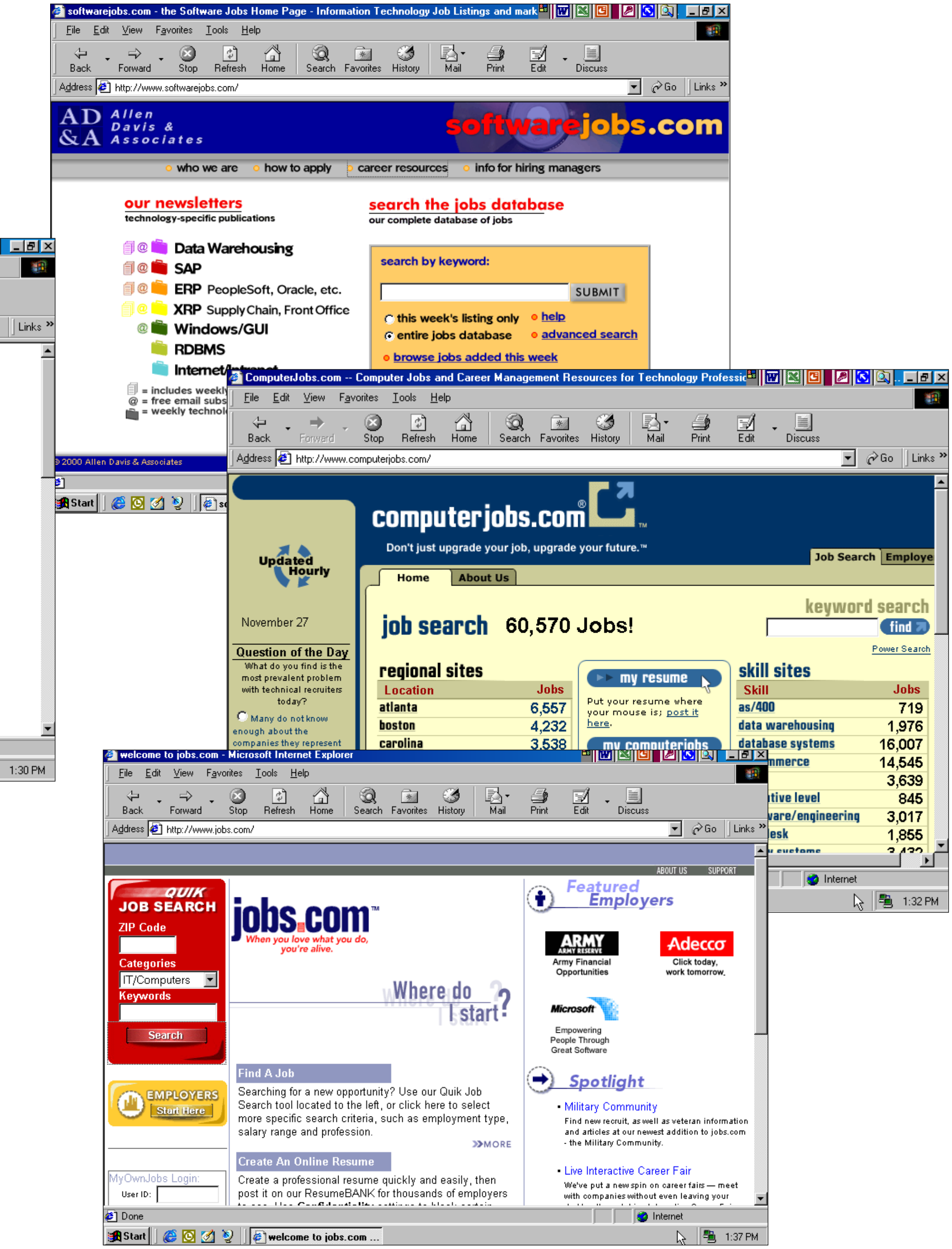
Web Link

For more information on employment projections, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Employment Projections.

Job opportunities in the industry are found primarily in four areas:

- Companies that manufacture computer-related equipment (hardware)
- Companies that develop software
- Companies that hire IT professionals to work with these products
- Companies and organizations that provide computer-related training and education

As in any major industry, the computer industry includes many service companies that support each of these four areas. Examples of such companies include firms that sell computer supplies or provide consultation on analysis, design, programming, and networking projects. You can find information on specific careers in each of these industries via typical job-searching methods, as well as on career-oriented sites on the World Wide Web (Figure 16-1).


softwarejobs.com - the Software Jobs Home Page - Information Technology Job Listings and mark
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://www.softwarejobs.com/
Go Links
AD & A Allen Davis & Associates
softwarejobs.com
who we are
how to apply
career resources
info for hiring managers
our newsletters
technology-specific publications
search the jobs database
our complete database of jobs
search by keyword:
SUBMIT
help
advanced search
browse jobs added this week
Start
1:30 PM
ComputerJobs.com -- Computer Jobs and Career Management Resources for Technology Professio
Address http://www.computerjobs.com/
computerjobs.com
Don't just upgrade your job, upgrade your future.™
Updated Hourly
Job Search
Employe
Home
About Us
keyword search
find
Power Search
my resume
my computerjobs
Internet
1:32 PM
welcome to jobs.com - Microsoft Internet Explorer
Address http://www.jobs.com/
ABOUT US
SUPPORT
QUIK JOB SEARCH
ZIP Code
Categories
Keywords
Search
jobs.com™
When you love what you do, you're alive.
Where do I start?
Featured Employers
ARMY ARMY RESERVE
Adecco
Microsoft
Spotlight
EMPLOYERS Start Here
MyOwnJobs Login:
User ID:
»MORE
Done
Internet
Start
welcome to jobs.com ...
1:37 PM

Data Warehousing
SAP
ERP PeopleSoft, Oracle, etc.
XRP Supply Chain, Front Office
Windows/GUI
RDBMS

○ this week's listing only
● entire jobs database

= includes weekl
= free email subs
= weekly technol

2000 Allen Davis & Associates

November 27

Question of the Day
What do you find is the most prevalent problem with technical recruiters today?
○ Many do not know enough about the companies they represent

job search 60,570 Jobs!

regional sites

Location	Jobs
atlanta	6,557
boston	4,232
carolina	3,538

Put your resume where your mouse is; post it here.

skill sites

Skill	Jobs
as/400	719
data warehousing	1,976
database systems	16,007
mmerce	14,545
	3,639
tive level	845
ware/engineering	3,017
esk	1,855

IT/Computers

Find A Job
Searching for a new opportunity? Use our Quik Job Search tool located to the left, or click here to select more specific search criteria, such as employment type, salary range and profession.

Create An Online Resume
Create a professional resume quickly and easily, then post it on our ResumeBANK for thousands of employers

Army Financial Opportunities

Click today, work tomorrow.

Empowering People Through Great Software

- Military Community
  Find new recruit, as well as veteran information and articles at our newest addition to jobs.com - the Military Community.
- Live Interactive Career Fair
  We've put a new spin on career fairs — meet with companies without even leaving your

ISSUE

Foreign Workers

H1B Visa Expansion Program

Millions of Americans are employed today in computer and telecommunications industries. In order for companies to remain competitive as the economy continues to grow, a technologically literate workforce is needed. In the United States, however, a major shortage of IT workers exists. The U.S. Congress has responded to this worker shortage by lifting the cap on the number of foreign workers that can be imported to fill these jobs. Many argue that the expansion of the H1B Visa skilled-labor immigration program (see URL below) is crucial to the future development of the economy in the United States. They contend that some of the world's best high-tech employees come from places other than the United States, so there should be legislation expanding the H1B Visa program. Others argue that this is a method for American companies to bring in cheap labor and drive down salaries of American workers. Should Congress expand the immigration program for additional IT workers? Why or why not? Should a time limit be set on those migrating to the United States? Should a minimum wage be established for IT workers?

For more information on the IT worker shortage and the Web site mentioned above, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 16 Issue #1.

Web Link

For more information on Web resources, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Web Resources.

The Computer Equipment Industry

The computer hardware industry consists of manufacturers and distributors of computers and computer-related equipment such as disk and tape drives, monitors, printers, and communications equipment (Figure 16-2).

Computer equipment manufacturers include such companies as Apple, Cisco, Compaq, Dell, Gateway, Hewlett-Packard, IBM, Intel, Lucent, QUALCOMM, Sun Microsystems, and 3Com. Many of these firms are huge organizations with thousands of employees worldwide. IBM, for example, is one of the largest computer companies with more than 307,000 employees and annual sales of more than $87 billion.

The computer equipment industry also is well known for the many start-up companies that appear each year. These new companies take advantage of rapid changes in equipment technology, such as wireless communications, networking, multimedia, and fiber optics, to create new products and new job opportunities. Often these companies offer stock options to induce college graduates to join their firm instead of the larger, more established companies. Many young graduates have become millionaires overnight by taking a chance with a start-up company.

Figure 16-2 A computer is assembled carefully.

In addition to the companies that make end-user equipment, thousands of companies build components that most users never see. These companies manufacture chips, motherboards, power supplies, peripherals, and the hundreds of other parts that are inside a computer.

Some of the more popular job titles that involve the design and manufacture of computer equipment are described in Figure 16-3. In larger companies there are several levels to each job title, including management careers.

Many companies list their job openings, internship opportunities, and career opportunities on their Web sites. The right column in Figure 16-4 lists the Web site addresses of some of the major computer equipment companies. If you are serious about interviewing with a company, you often can obtain a wealth of information about the firm and its employment opportunities by visiting the company's Web site. Some companies even allow you to submit your resume online.

The Computer Software Industry

The computer software industry is composed of companies that develop, manufacture, and support a wide range of software products, such as operating systems and other systems software; productivity software; network software; software development tools; and Internet software and technologies.

COMPUTER EQUIPMENT INDUSTRY POSITIONS

Title	**Median Salary Range** *(in thousands of $)*		
	1999	2000	Change %
Digital signal processor (DSP) designer	80.0	87.5	9.3
Integrated circuit (IC) designer	90.7	101.1	11.5
Systems integrator	76.8	84.8	10.4
Wireless designer	77.4	84.1	8.7

Figure 16-3 Popular job titles involving the design and manufacture of computer equipment.
(Source: EE Times Salary & Opinion Survey, CMP Media Inc.)

Web Link
For more information on salaries, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Salaries.

WEB SITE ADDRESSES FOR MAJOR COMPANIES

Hardware Company	URL
Apple Computer, Inc.	apple.com/jobs
Cisco Systems, Inc.	cisco.com/jobs
Compaq Computer Corporation	vcmproapp04.compaq.com/jobs/index.html
Dell Computer Corporation	dellapp.us.dell.com/careers
Gateway, Inc.	jobs.gateway.com
Hewlett-Packard Company	jobs.hp.com
IBM Corporation	www.empl.ibm.com
Intel Corporation	intel.com/jobs/students
Lucent Technologies	lucent.com/work/work.html
QUALCOMM Incorporated	www.qualcomm.com/HR
Sun Microsystems, Inc.	sun.com/corp_emp/zone/index.html
3Com Corporation	3com.com/inside/college

Software Company	URL
Adobe Systems, Inc.	www.adobe.com/aboutadobe/careeropp
Computer Associates International, Inc.	cai.com/career/cajobs.htm
IBM Corporation	www.empl.ibm.com
Intuit Inc.	intuit.com/corporate/hr
Macromedia, Inc.	macromedia.com/macromedia/hr
Microsoft Corporation	microsoft.com/jobs
Network Associates, Inc.	job4.cbdr.com/networkassoc
Novell, Inc.	www.novell.com/company/careers
Oracle Corporation	oracle.com/corporate/employment
Sybase, Inc.	sybase.com/corporate/careers
Symantec Corporation	symantec.com/corporate/hr/index.html

Internet Company	URL
Amazon.com. Inc.	amazon.com
America Online, Inc.	corp.aol.com/careers
EarthLink, Inc.	www.earthlink.com/about/jobs
eBay Inc.	ebaycareers.com
E*Trade Securities, Inc.	e-trade.com
At Home Corporation (Excite)	corp.excite.com/jobs
Lycos, Inc.	lycos.com/careers
Microsoft Corporation	microsoft.com/jobs
RealNetworks, Inc.	real.com/company/index.html
theglobe.com	theglobe.com
Music.com, Inc.	music.com/company
Yahoo! Inc.	join.yahoo.com

Noncomputer-Related Company	URL
AT&T	att.com/hr/ur
The Boeing Company	boeing.com/employment/college.html
Caterpillar, Inc.	cat.com/about_cat/employment/employment.html
Chevron Corporation	www.chevron.com/about/hr
Disney	disney.go.com/DisneyCareers
General Motors Corporation	generalmotors.com/company/careers
McDonald's Corporation	mcdonalds.com/corporate/careers
Merck & Co., Inc.	merck.com
Merrill Lynch & Co., Inc.	ml.com/careers
Pfizer Inc.	pfizer.com/pfizerinc/career
The Procter & Gamble Company	pg.com/jobs/sectionmain.jhtml
Union Carbide	unioncarbide.com/recruit/uccrec.html
Wal-Mart Stores, Inc.	walmartstores.com/careers

Figure 16-4 This table lists the Web site addresses for the major hardware, software, Internet, and noncomputer-related companies. When you visit a Web site, you may have to click a link, such as About or Company Information, to obtain a list of employment opportunities and other career-related information.
For an updated list, visit scsite.com/dc2002/ch16/careers.htm.

APPLY IT!

Resume Online

The days of putting pencil to paper and wearing out the soles of your shoes during a job search are in the past. Today, you are more likely to wear out your keyboard. The Internet can provide a point of introduction between you and potential employers around the world. Just publish your resume on a Web site, sit back, and wait for the job offers. Before publishing your resume online, you may want to use resume building software such as Web Resume Writer.

To publish your resume, you can select from several options. You may want to use one of the free Web page sites such as GeoCities or Tripod. A second option is to have your own Web site. Several Web sites offer free Web site hosting services.

Third, many job seekers use the resume database feature supported by many of the online career recruitment Web sites. Most of these Web sites, such as Monster.com, provide e-forms into which you can publish your information. If you use one of the forms, the first step is to start with a plain, simple resume. Use a simple font like Courier or Times New Roman. Avoid columns and tabs and formatting with bold, italics, script, graphics, and borders.

For more information on online resumes and the Web sites mentioned above, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #1.

Web Link

For more information on benefits, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Benefits.

Some software companies specialize in a particular type of software product such as business productivity software, utility programs, or multimedia and graphic design tools. Other software companies, especially larger firms, produce and sell multiple software products.

The software industry is a huge one, with annual sales exceeding $200 billion. Leading software companies include Adobe Systems, Computer Associates, IBM, Intuit, Macromedia, Microsoft, Novell, Oracle, Sybase, and Symantec. The largest software company, Microsoft, has more than 300 products and technologies, 39,900 employees, and annual sales of more than $33 billion.

Career opportunities in the software industry involve designing and programming all kinds of software products, including application software for business, productivity software, educational programs, entertainment software, and systems software. Figure 16-5 describes some of the popular job titles used for careers related to the development of software.

The right column in Figure 16-4 on the previous page lists the Web site addresses of some of the major software companies. As with the computer equipment companies, you may wish to visit a software company's Web site to obtain information on specific job openings and career opportunities.

Web Link

For more information on the computer software industry, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Computer Software Industry.

IT Professionals

In many companies, the IT department includes professionals who set up and manage the computer equipment and software to ensure that it produces information for the end user. In addition to other jobs, IT professionals include programmers and systems analysts that companies hire to work in an IT department. The next section discusses these and other careers available within most IT departments. In the fast-paced world of technology, job titles are not standardized. Some companies are shrinking their number of titles, while others invent new ones each time someone is hired.

IT Career Opportunities

Without computers, very few companies could operate in today's economy. For some, computers help ensure smooth communications between corporate offices. Other firms use computers to order raw materials automatically, control manufacturing, and ship finished goods. In many cases, the only time a human is involved in the process is in designing and writing the programs that tell the computer what to do each step of the way. This dependency on computers has created thousands of new high-tech jobs, even in noncomputer-related companies. For many firms, the use of technology separates them from their

COMPUTER SOFTWARE INDUSTRY POSITIONS

Title	Function	Minimum Education	Median Salary Range *(in thousands of $)*
Programmer/ Analyst	Design, write, and test computer programs	B.S. in Computer Science or Information Technology	62.5
Project engineer	Analyze software requirements, design software solutions, and oversee the software development process	B.S. in Computer Science or Electrical Engineering	74.7
Software engineer	Develop system software such as operating systems, utilities, and software drivers	B.S. in Computer Science or Electrical Engineering	71.3

Figure 16-5 Popular job titles for software development careers.

(Sources: EE Times Salary & Opinion Survey, CMP Media Inc.; Information Technology Salary Survey, kforce.com)

competitors and is a distinction they highlight on their Web sites (see Figure 16-4 on page 16.5).

Because of rapid changes in technology, many current jobs did not even exist just a few years ago. For example, the World Wide Web, which began in 1993, has spawned thousands of Internet Content/Commerce/Provider companies (see Figure 16-4) that demand Web designers and network specialists to create and maintain their Web sites. These jobs are described in Figure 16-6.

The following sections describe some current career opportunities in an IT department.

INTERNET INDUSTRY POSITIONS

Title	Function	Minimum Education	Median Salary Range *(in thousands of $)*
Project manager	Supervises the development and execution of Internet or e-commerce systems; works with the company's marketing and customer service divisions	B.S. in Management Information Technology	81.5
Web administrator	Oversees Web site performance; maintains Web link between company's Web server and ISP	B.S. in Information Technology	57.5
Web developer	Analyzes, designs, implements, and supports Web applications. Works with HTML, JavaScript, and multimedia	B.S. in Information Technology	63.2
Web graphic designer	Develops graphical content using Photoshop, Flash, and multimedia	B.S. in Information Technology	64.9
Web programmer	Supports the company's Internet strategy by analyzing, designing, implementing, and supporting Web-related applications	A.A.S. or A.S. in Information Technology	66.9
Webcaster	Creates and delivers Webcasts featuring streaming rich media, including audio, video, and Web-based multimedia	A.A.S. or A.S. in Information Technology	62.5
Webmaster	Maintains an organization's Web site; creates or helps users create Web pages	B.S. in Information Technology	52.2

Figure 16-6 This table shows some of the jobs available in the Internet field.

(Sources: Information Technology Salary Survey, kforce.com; Occupational Outlook Handbook, Bureau of Labor Statistics, U.S. Department of Labor)

Web Link

For more information on career mobility, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Career Mobility.

TECHNOLOGY TRAILBLAZER

MARC **ANDREESSEN**

Drinking a great cup of coffee and sleeping until 3:00 p.m. make Marc Andreessen happy. But he certainly is happy, too, about the success of his programs, Mosaic and Netscape Navigator.

As a computer science student at the University of Illinois, Andreessen worked as a part-time programmer at the university's National Center for Supercomputing Applications (NCSA) and became familiar with the Internet, which was primarily a text-based resource used almost exclusively by scientists and scholars.

Andreessen and a friend worked 18 hours a day to create NCSA Mosaic in 6 weeks. Although slow and unstable, the program gave users a user-friendly graphical tool to browse the Web by jumping from links to other Web pages with a click of the mouse.

After graduating in 1994, Andreessen accepted a job as a programmer in California's Silicon Valley. He and some colleagues from NCSA met with Jim Clark, who invested $4 million in a new company, called Netscape Communications. They decided to "create a Mosaic killer" and developed the Netscape browser.

Today, Andreessen works at Loudcloud, a company he co-founded to provide technology and software to Internet startups.

For more information on Marc Andreessen, visit the Discovering Computers 2002 People Web page (**scsite.com/dc2002/people.htm**) and click Marc Andreessen.

Working in an IT Department

The people in an IT department work together as a team to meet the information demands of their organization. Several jobs have been discussed previously, including database administrators (Chapter 13), systems analysts (Chapter 14), and programmers (Chapter 15). In addition to these jobs, many other careers exist. Generally, these jobs fall into five main groups:

1. Management
2. Operations
3. System development
4. Technical services
5. End-user computing

The table in Figure 16-7 shows some of the jobs in each group in a typical IT department. The management group directs the planning, research, development, evaluation, and integration of technology. The operations group is responsible for operating the centralized computer equipment and administering the network including both data and voice communications. The system development group is responsible for analyzing, designing, developing, and implementing new information technology and maintaining and improving existing systems. The technical services group is responsible for evaluating and integrating new technologies, administering the organization's data resources, and supporting the centralized computer operating system or servers. The end-user computing group is responsible for assisting end users in working with existing systems and in using productivity software and query languages to obtain the information necessary to perform their jobs.

An IT department provides career opportunities for people with a variety of skills and talents. Other information industry jobs are found in the areas of education and training, sales, service and repair, and consulting.

COMPANY ON THE CUTTING EDGE

divine interVentures™
The Internet Zaibatsu™

Creating Commerce for Chicago

When you think of Chicago, you most likely envision windy weather, Michael Jordan, and pizza. If Andrew "Flip" Filipowski is successful, you might add Internet technology to your list of Chicago's claims to fame.

Filipowski is the head of divine interVentures, an Internet holding company. He believes that Chicago is ripe for a thriving Internet economy due to its 8,000 technology-based corporations, top educational institutions, and hard-working residents. A multitude of other investors agrees, including Microsoft, Dell Computer, Compaq Computer, Hewlett-Packard, Aon Corporation, the Chicago Tribune, and Michael Jordan.

In 2000, Filipowski offered shares in divine to public investors. These backers share his passion to create an Internet *Zaibatsu*™ community, which is a Japanese term for a family of businesses working collaboratively to create mutual opportunity and gain. Using this model, entrepreneurs will be able to focus on their core businesses while divine supplies managerial expertise, networking resources, and industry knowledge. Filipowski believes these relationships and synergies will help Chicago build its high-tech industry.

For more information on divine interVentures, visit the Discovering Computers 2002 Companies Web page (**scsite.com/dc2002/companies.htm**) and click divine interVentures.

INFORMATION TECHNOLOGY POSITIONS

Group	Job Title	Function	Minimum Education	Median Salary Range (in thousands of $)
Management	MIS director/CIO	Directs the company's information service and communications functions	B.S. in Management Information Technology	129
	Project leader	Coordinates projects; performs systems analysis and programming tasks	B.S. in Management Information Technology	72.6
	Project manager	Oversees all assigned projects; allocates resources, selects teams, conducts performance appraisals	B.S. in Management Information Technology	81.5
Operations	Computer operator	Performs equipment-related activities such as monitoring performance, running jobs, backup, and restore	A.A.S. or A.S. in Information Technology	33.5
	Data communications analysts	Evaluates, installs, and monitors data and/or voice communications equipment and software and maintains connections to the Internet and other wide area networks	B.S. in Management Information Technology or Electrical Engineering Technology	47.6
	Network (LAN) administrator	Installs and maintains local area networks; identifies and resolves connectivity issues	B.S. in Management Information Technology or Electrical Engineering Technology	59.4
System development	Application programmer	Converts the system design into the appropriate computer language, such as Visual Basic, Java, C, and C++	A.A.S. or A.S. in Information Technology	46.7
	Computer science engineer/ Software engineer	Specifies, designs, implements, tests, and documents high-quality software in a variety of fields, including robotics, operating systems, animation, and applications	B.S. in Computer Science	62.9
	Technical writer	Works with the analysts, programmers, and users to create system documentation and user materials	A.A.S. or A.S. in Information Technology; B.A. in English	51.1
	Systems analyst	Works closely with users to analyze their requirements, design and develop new hardware and software systems, and incorporate new technologies	B.S. in Management Information Technology	54.3
Technical services	Database analyst/Data modeler	Uses data modeling techniques and tools to analyze, tune, and specify data usage within an application area	B.S. in Computer Science or Information Technology	71.1
	Desktop publishing specialist	Produces documents such as newsletters, brochures, and books by combining text and graphics	Certificate	39.1
	Graphic designer/ illustrator	Creates visual impressions of products and advertisements in the fields of graphics, theater, interior design, jewelry, and fashion	Certificate	31.7
	Network security specialist	Configures routers and firewalls; specifies Web protocols and enterprise technologies	B.S. in Computer Science or Information Technology	64.0
	Quality assurance specialist	Reviews programs and documentation to ensure they meet the organization's standards	B.S. in Information Technology	61.6
	System programmer	Installs and maintains operation system software and provides technical support to the programming staff	B.S. in Computer Science or Information Technology	78.3
End-user computing	Computer technician/ Computer service technician	Installs and supports personal computer equipment and software; troubleshoots client and/or server problems	A.A.S. or A.S. in Information Technology	33.9
	Help desk specialist	Solves procedural and software questions in person and over the telephone for hardware, software, or telecommunications systems	A.A.S. or A.S. in Information Technology	39.7

Figure 16-7 This table shows some of the careers available in each of the five main groups in a typical IT department.

(Sources: Information Technology Salary Survey, kforce.com; Occupational Outlook Handbook, Bureau of Labor Statistics, U.S. Department of Labor)

Education and Training

The increased sophistication and complexity of today's computer products has opened extensive opportunities in computer-related education and training (Figure 16-8). Schools, colleges, universities, and private companies all need qualified instructors. The high demand for instructors, in fact, has led to a shortage of qualified instructors at the university level as educators increasingly are lured into private industry by the promise of higher pay. This shortage probably will not end in the near future because the supply of educators with Ph.D. degrees is not keeping pace with the demand.

Sales

Sales representatives must have a general understanding of computers and a specific knowledge of the product they are selling. Strong interpersonal, or people, skills are important, including listening ability and strong oral and written communications skills. Companies usually pay sales representatives based on the amount of product they sell; top sales representatives often are among an organization's more highly compensated employees.

Some sales representatives work directly for hardware and software manufacturers (see Figure 16-4 on page 16.5). Others work for resellers, including retailers that sell personal computer products such as CompUSA, Best Buy, and OfficeMax (Figure 16-9).

Service and Repair

Being a service and repair technician is a challenging job for individuals who like to troubleshoot and solve problems and have a strong background in electronics (Figure 16-10). In the early days of computers,

Figure 16-8 A high demand exists in schools and industry for qualified instructors who can teach IT subjects.

Figure 16-9 Computer retailers need sales people who understand personal computers and have good people skills.

technicians often made repairs at the site of the computer equipment. Today, however, technicians first will replace a malfunctioning component, such as a hard disk, and then take the faulty part back for repair at their office or at a special repair facility. Many computer equipment manufacturers include special diagnostic software with their computer equipment that helps service technicians identify any problems. Some computers even use a modem to telephone a computer automatically at a service technician's office to leave a message that a malfunction has been detected.

Consulting

After building experience in one or more computer and IT-related areas, an individual might decide to become a **consultant**, someone who draws upon his or her experiences to give advice to others. Consultants not only must have strong technical skills in their area of expertise, but they also must have the people skills necessary to communicate their suggestions effectively to their clients. Qualified consultants are in high demand for tasks such as computer selection, system design, communications, network design and installation, and Web development.

PREPARING FOR A CAREER IN THE COMPUTER INDUSTRY

To prepare for a career in the computer industry, you first must decide on the area in which you are interested and then obtain education in that field. According to the U.S. Bureau of Labor Statistics, the fastest growing computer jobs through the year 2008 will be computer engineer, computer support specialist, systems analyst, database administrator, and desktop publishing specialist (Figure 16-11).

Figure 16-10 Computer service and repair require knowledge of electronics.

Web Link

For more information on the computer equipment industry, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Computer Equipment Industry.

Web Link

For more information on information systems consulting, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Information Systems Consulting.

FASTEST GROWING IT POSITIONS

Title	Employment		Change	
	1998	2008	Number	%
Computer engineer	299,000	622,000	323,000	108
Computer support specialist	429,000	869,000	439,000	102
Systems analyst	617,000	1,194,000	577,000	94
Database administrator	87,000	155,000	67,000	77
Desktop publishing specialist	26,000	44,000	19,000	73

Figure 16-11 Projected growth rates for the five fastest-growing IT jobs.
(Source: Occupational Outlook Handbook, Bureau of Labor Statistics, U.S. Department of Labor)

The Web sites listed in the Getting Started category in Figure 16-12 will guide you through the prerequisites and opportunities in each field. The Microsoft Skills Web site is especially helpful. You also can obtain career information by visiting the Web sites listed in the Professional Organizations and Job Opportunities categories in Figure 16-12.

Choosing the Right Course of Study

Three broad disciplines in higher education produce the majority of entry-level employees in the computer industry: computer information systems, computer science (also referred to as software engineering), and computer engineering. The characteristics of each program are summarized in Figure 16-13 and discussed in the following paragraphs.

Computer information systems (CIS) programs emphasize the practical aspects of computing. After two years of study, students often receive an Applied Associate in Science (A.A.S.) degree or an Associate in Science (A.S.) degree with an emphasis in application programming. In four-year programs, students work toward and receive a Bachelor of Science (B.S.) degree with an emphasis in systems programming, systems analysis and design, or networking. In many cases, local community colleges offer the A.A.S. or A.S. degree. Students then transfer to a four-year college or university to complete their B.S. degree.

CAREER PREPARATION WEB SITES

WEB SITE	URL
Getting Started	
Bureau of Labor Statistics	stats.bls.gov/blshome.htm
Careers in Computing	tcm.org/html/resources/cmp-careers cnc-topdrawer.html
Computer Programmers	stats.bls.gov/oco/ocos110.htm
Green Thumb/Microsoft Skills	www.greenthumb.org
Making College Count	makingitcount.com/yournextjob/start
Scholarships	fastweb.com
Professional Organizations	
Association for Computing Machinery	acm.org
Association for Information Systems	aisnet.org
Association of Information Technology Professionals (formerly DPMA)	aitp.org
IEEE Computer Society	computer.org
Institute of Electrical and Electronics Engineers	ieee.org
Job Opportunities	
CareerBuilder	careerbuilder.com
ComputerJobs.com	computerjobs.com
HotJobs.com	hotjobs.com/htdocs/channels/tech
JobOptions	joboptions.com
Monster.com	monster.com
Computer Industry Training	
Microsoft Training and Certification	microsoft.com/trainingandservices/training
Novell Education and Certification	www.novell.com/education
Certification	
Adobe Certified Training Provider Program	partners.adobe.com/asn/training
Cisco Connection Online	cisco.com
Computing Technology Industry Association (CompTIA)	comptia.org
Institute for Certification of Computer Professionals	www.iccp.org
Microsoft Training and Certification	microsoft.com/traingandservice/mcp
Novell Professional Certifications	www.novell.com/education/certinfo
Sun Educational Services	suned.sun.com/HQ/certification
Certified Internet Webmaster	ciwcertified.com
Publications and Web News	
Computerworld	computerworld.com
InfoWorld.com	infoworld.com
EarthWeb Datamation	datamation.earthweb.com
internet.com	internet.com
eWeek	zdnet.com/eweek

Figure 16-12 These Web sites help in career preparation in the computer industry. *For an updated list, visit scsite.com/dc2002/ch16/careers.htm.*

Web Link

For more information on U.S. Commerce reports, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click U.S. Commerce Reports.

DISCIPLINE DIFFERENCES

Computer Information Systems	Computer Science/ Software Engineering	Computer Engineering
Practical and application-oriented	Theoretical oriented	Design oriented
Business and management oriented	Mathematics and science oriented	Mathematics and science oriented
Understanding how to design and implement information systems	Understanding the fundamental nature of software	Understanding the fundamental nature of hardware
Degrees include A.A.S., B.S., M.S., Ph.D.	Degrees include B.S., M.S., Ph.D.	Degrees include B.S., M.S., Ph.D.

Figure 16-13 The major differences among the computer information systems, computer science/software engineering, and computer engineering disciplines.

Web Link

For more information on IT training, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click IT Training.

If you are attending a community college, ask your advisor if the school has an **articulation agreement** with a nearby college or university. An articulation agreement ensures that, if you transfer to a college or university, you will receive credit for most of the courses you took at the community college level. In general, a computer information systems program does not require its majors to have a strong mathematics and science background, but those courses do help.

Computer science (**CS**), also called **software engineering** (**SE**), programs stress the theoretical side of programming. A computer science curriculum typically emphasizes systems programming, rather than applications programming. In general, CS programming courses are more rigorous than CIS programming courses. Students thus are required to take several mathematics and science courses before enrolling in the majority of computer science courses.

Computer engineering (**CE**) programs teach students how to design and develop the electronic components found in computers and peripheral devices. Students usually are required to take mathematics, physics, and basic engineering courses before taking the more in-depth computer engineering design and development courses.

As in most other industries, individuals with advanced degrees in specific fields have a better chance of success. Thus, to round out their education, instead of continuing down a narrow path with a second degree in the computer area, many graduates with a computer degree change direction and obtain a Masters in Business Administration (M.B.A.) degree.

Attending a Trade School

An alternative to enrolling in a college or university is to attend a trade school. Trade schools offer programs primarily in the areas of programming and maintenance. One advantage of attending a trade school is time; students often can complete trade school programs in a shorter time than college and university programs because generally they are not required to take science or humanities courses. As with any post-secondary school, when deciding on a trade school, you should compare curricula, laboratory facilities, instructors, and the types of jobs the school's graduates have obtained. While not having a college degree may limit a person's opportunities for securing a top position, it neither will prevent entry into nor preclude success in the computer industry.

TECHNOLOGY TRAILBLAZER

JERRY **YANG**

As self-proclaimed "Chief Yahoo," Jerry Yang says he feels proud and satisfied to have lead Yahoo! to the top spot among Internet portals. But he adds that he does not consider himself successful yet. "So much that I want to do remains to be done," he explains. "It's important to continue to be modest and paranoid."

Born in Taiwan in 1967, Yang was 10 years old and knew very little English when he came to the United States with his mother and his younger brother. In college at Stanford University, he completed both his bachelor's and master's degrees in electrical engineering in just four years. At Stanford, David Filo was the teaching assistant for one of Yang's classes. In late 1993, Yang and Filo worked in a trailer on campus and began creating Jerry's Guide to the World Wide Web, the precursor to today's Yahoo!.

Yang and Filo left Stanford's Ph.D. program to work on their growing company. Yang says he might go back to college because "Being in school was very fun, and maybe someday I'll go back to do something else!"

For more information on Jerry Yang, visit the Discovering Computers 2002 People Web page (**scsite.com/dc2002/people.htm**) and click Jerry Yang.

Planning for Career Development

The computer- and IT-related industry is one of the more fluid parts of today's marketplace. Someone who is an expert today can be a has-been tomorrow. As a computer professional, you must find methods to keep up to date on industry trends and technologies, to develop new skills, and to increase recognition among peers within your company. Three primary ways to achieve these objectives are through professional organizations, certification, and professional growth and continuing education activities. Numerous computer publications also can help an individual keep up with changes in the computer industry.

Professional Organizations

Computer professionals with common interests and a desire to extend their proficiency have formed computer-related professional organizations to share their knowledge. Two professional organizations that have been influential in the industry are the Association for Computing Machinery (ACM) and the Association of Information Technology Professionals (AITP). The **Association for Computing Machinery** (**ACM**) is a scientific and educational organization dedicated to advancing information technology. The ACM is composed of professionals and students working and interested in computer science and computer science education. A large number of college and university computer educators are members of the ACM. The **Association of Information Technology Professionals**, formerly called the Data Processing Management Association (DPMA), is a professional association of programmers, systems analysts, and information processing managers. Both ACM and AITP offer the following features and benefits:

Web Link

For more information on IT careers, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click IT Careers.

- Chapters throughout the United States, for both professionals and students
- Monthly meetings
- Workshops, seminars, and conventions
- Publications, including magazines, journals, and books that help computing professionals negotiate industry and career challenges
- Special Interest Groups (SIGs), that bring together members with shared interests, needs, knowledge, and experience
- Programs to help with continuing education needs

Attending professional meetings provides an excellent opportunity for students to learn about the information processing industry and to meet and talk with professionals in the field. Figure 16-12 on page 16.12 presents a list of professional organizations and their URLs.

In addition to these and other professional organizations, user groups exist for a wide range of computers, operating systems, application software, and more. A **user group** is a collection of people with common computer equipment or software interests that meets regularly to share information. Most metropolitan areas have one or more local computer user groups that convene monthly to discuss mutual interests about personal computers. Figure 16-14 shows a list of major user group organizations and their URLs. For anyone employed or simply interested in the computer industry, these groups can be an effective and rewarding way to learn and continue career development.

Professional Growth and Continuing Education

Staying aware of new products and services in the computer industry can be a challenging task because technology changes so rapidly. One way to stay informed about the industry is to participate in professional growth and continuing education activities. This broad category includes events such as workshops, seminars, conferences, conventions, and trade shows. These events provide both general and specific information on equipment, software, services, and issues affecting the industry. Workshops and seminars usually last one or two days, while conferences, conventions, and trade shows can run for a week. One of the larger technology trade shows in the world, **COMDEX**, brings together more than 2,100 vendors and 200,000 attendees (Figure 16-15).

USER GROUP ORGANIZATION

Organization	URL
Apple User Groups	apple.com/usergroups/program
Association of Personal Computer User Groups (APCUG)	www.apcug.org
Microsoft Mindshare User Group Program	microsoft.com/mindshare/default.asp
User Group Relations	ugr.com

Figure 16-14 The Web sites for the major user group organizations. *For an updated list, visit scsite.com/dc2002/careers.htm.*

Many companies also offer training on their products in the form of books, video-based training, computer-based training (CBT), Web-based training (WBT), and instructor-led training in a classroom.

Computer Publications

Another way to stay informed about happenings in the computer industry is to read one or more computer industry publications regularly (Figure 16-16) or visit the Web News sites listed in Figure 16-12 on page 16.12. Hundreds of publications are available from which to choose. Some magazines, such as *PC Week*, *Computerworld*, and *InfoWorld*, are similar to newspapers and cover a wide range of issues. Other periodicals are oriented toward a particular topic such as communications, personal computers, or a specific equipment manufacturer. You can find many of the more popular publications in public or school libraries; most of them also have Web sites you can visit for news on the latest developments in the computer industry. For exact Web site addresses, review the Publications and Web News category in Figure 16-12.

Figure 16-15 COMDEX, held each November in Las Vegas, Nevada, is one of the larger technology trade shows in the world. More than 2,100 vendors display their newest products and services to more than 200,000 attendees.

Web Link
For more information on IT professionals, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click IT Professionals.

Web Link
For more information on professional organizations, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Professional Organizations.

Web Link
For more information on issues, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Issues.

Figure 16-16 Numerous computer industry publications are available.

WHAT IS COMPUTER CERTIFICATION?

Certification is a way for employers to ensure a level of competency, skills, or quality in a particular area. Companies are looking for certified professionals with the knowledge and skills to work with and maintain complex systems. Now more than ever, computer innovations are spawning major opportunities in new occupations within the IT industry. Certification continues to ensure quality and workmanship standards and is one way companies can help ensure their workforce remains up to date on computers and technology.

Computer certification demonstrates the mastery of a skill set and knowledge base in a specific IT area. Computing professionals typically obtain a certification by passing an examination. The certification process requires experience or special classes, many of which are offered by community colleges and adult education centers. After certification requirements are met, proficiency in an area is acknowledged.

Many vendors such as Microsoft and Novell offer technical certification programs for their software products. These vendors use examinations to determine if a person is qualified for certification. Some of the benefits of certification include:

- Proof of professional achievement, a level of competence commonly accepted and valued by the industry.
- Enhancement of job opportunities. Many employers give preference in hiring applicants with certification. They view this as proof that a new hire knows the procedures and technologies required.
- Opportunity for advancement. Certification can be a plus when an employer awards job advancements and promotions.

The hottest IT trends bring with them a vast array of certifications. As shown in Figure 16-17, a sponsoring organization develops and administers each certification. These **sponsors** include computer hardware and software vendors, independent training companies, and professional organizations. Both IT professionals and computer services end-users should be familiar with IT certifications, know certification benefits and limitations, and recognize the more popular certification designations. These topics are explained in this section. Also included is information about certification preparation, examinations, and resources. Finally, career development after certification is discussed. Each month, more

TYPES OF COMPUTER CERTIFICATION

The IT industry has grown by phenomenal proportions, and certification has grown as quickly. Today, more than 200 certifications are available. Each month, more

NOVELL AUTHORIZED CNE
tekmetrics
Greg Bigelow
Windows NT Administrator
Certificate of Achievement
Microsoft Office User Specialist
Mark Reimold
Institute for Certification of Computing Professionals
Keith A. Tennant
tekmetrics
Greg Bigelow
Master High IT Aptitude
September 1, 1999
Certificate of Excellence
DRAVET
Microsoft Certified Professional
Microsoft Certified Professional
Systems Engineer

Figure 16-17 Many certifications are available in the information technology industry.

certifications are announced. Some certifications have a broad focus, while others require an in-depth knowledge of a single computing aspect. Often, a sponsor establishes a series of related certifications to show levels of expertise within a single area.

As shown in Figure 16-18, certifications usually are classified based on the computer industry area to which they most closely relate: software applications, operating systems, programming, hardware, networking, Internet, and database systems. Some certifications are closely related to more than one category. For example, a certification in networking also may indicate knowledge of hardware and operating systems.

A GUIDE TO COMPUTER CERTIFICATION

This section describes the major certifications and certification sponsors. The certifications are categorized by their role in the IT industry: software applications, operating systems, programming, hardware, networks, the Internet, and database systems.

Some certifications have components that fall into multiple categories. In this case, they are placed in the area for which they are known best. Each category includes an overview. In addition, APPLY IT boxes describe the requirements for several popular certifications. Tables within each area list the URLs for major certification sponsors.

Figure 16-18 Certifications relate to areas of information technology.

Web Link

For more information on certification, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Certification.

ISSUE

Certification – Is It Worth the Price?

The Value of Certifications

Certification has developed as part of the computer industry itself, and for the most part, as a commercial enterprise. No one organization oversees or sets standards for certifications. Some certifications are more respected and have a higher demand than others. Certifying sponsors set their own certification requirements. Some certifications are extremely rigorous, requiring an individual to complete extensive training and pass a number of tests. Other certifications have been compared with a rubber stamp. Even certifications offered by the same sponsor have varying worth. When more certifications are conferred than the market can support, a certification loses its value. In this case, it is to the sponsor's advantage to adjust the test to increase the certification's value. Already organizations such as the American Association of Internet Professionals (AIP) are establishing systems of accreditation to provide quality control and rank certifications (see URL below). How important is it to investigate a certification to determine its worth? Should the certification sponsor adjust the degree of difficulty of a test? Are certifications more important than college degrees?

For more information on the value of certification, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 16 Issue #2.

Software Applications Certifications

Although numerous software packages exist, several have achieved national recognition for use as productivity tools, including Microsoft Office Professional, Adobe Photoshop, Autodesk AutoCad, and Lotus Notes. As with most certifications, professionals can take an end-user certification test by registering with a vendor-authorized testing facility. The companies listed in the table in Figure 16-19 have a partner training program and encourage computer-training centers to become authorized training representatives.

Obtaining an end-user certification is very helpful to anyone who works in the computer industry, such as application trainers, help desk operators, and personal computer sales representatives. People who work in the following areas can benefit from software application certifications:

- Desktop publishers
- Draftspeople
- Graphical designers
- Layout editors
- Office managers/workers
- Photographers

Operating Systems Certifications

Several options representing different knowledge levels are available for those seeking operating system certifications. These certifications focus on particular skills — the user, the operator, the system administrator, and the system engineer. Since the inception of the Internet, networking has grown in importance, spawning new certifications that include operating system and networking components. For example, the Microsoft Certified Professional (MCP) and Microsoft Certified Systems Engineer (MCSE) are two certifications that validate a professional’s knowledge of Microsoft’s operating systems. The Red Hat Certified Engineer (RHCE) program validates mastery of the Linux operating system. IBM certifications are UNIX oriented, but they are specific to particular computers manufactured by its namesake.

If you are interested in an occupation as an operating system administrator or engineer, you also may benefit from certifications in networking, hardware, and the Internet. These additional certifications are closely linked to the operating system and would serve to broaden your expertise in that area.

The table in Figure 16-20 lists a few of the certifications available in the operating system area. People in the following jobs may be interested in a certification in operating systems:

- Computer consultants
- Hardware technicians
- Help desk operators
- System administrators

SOFTWARE APPLICATIONS

Certifications	URL
Adobe Systems Inc. Adobe Certified Expert (ACE)	partners.adobe.com/asn/training
Autodesk, Inc. AutoCAD Certified Professional (ACP)	autodesk.com/exams
Lotus Certified Lotus Specialist (CLS)	lotus.com/education
Microsoft Microsoft Office User Specialist (MOUS)	mous.net

Figure 16-19 Web sites for software applications certifications.
For an updated list of training centers, visit scsite.com/cert.htm.

OPERATING SYSTEMS

Certifications	URL
IBM IBM Certified Specialist	ibm.com/education/certify
Microsoft Microsoft Certified Professional (MCP) Microsoft Certified Systems Engineer (MCSE)	microsoft.com/train_cert
Redhat Red Hat Certified Engineer (RHCE)	redhat.com
Sun Microsystems Certified System Administrator	suned.sun.com

Figure 16-20 Web sites for operating systems certifications.
For an updated list of training centers, visit scsite.com/cert.htm.

Programming Certifications

Various certifications are available in the programming area. These certifications are valuable in two ways. First, a programming certification usually is supported with training programs that prepare applicants for the certification test. Secondly, programmers can add to their knowledge and skill base. The preparation classes for certifications provide excellent methods for approaching programming programs and an opportunity for professionals to share ideas.

APPLY IT!

Microsoft Office User Specialist

The Microsoft Office User Specialist (MOUS pronounced mouse) program is a Microsoft certification designed to measure and validate users' skills with these areas of Microsoft Office: Word, Excel, PowerPoint, Access, and Outlook (see URL below). Core and expert certification levels exist for most Office releases. You can take a Core examination for a single application within Office to obtain the User Specialist title. You are issued the Expert Specialist designation by passing an Expert level exam in one application area. The Microsoft Office Master designation is achieved by successfully completing the highest level exam for each of the five Office applications.

Requirements to become MOUS certified are as follows:

1. Register for an exam in your chosen area of expertise and certification level.
2. Take the exam and pass with a score of 80 percent or better.

The cost of the exam is $65 to $100 for each test, and testing format is computer-based performance.

Authorized training centers, including many colleges and adult education programs, are available to prepare for certification. Educational costs are $60 to $200 per class, which may vary in length from two to four hours. The tests can be taken without attending a training program. Alternate training methods may be used.

For more information on Microsoft and the MOUS certification, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #2.

APPLY IT!

Microsoft Certified Systems Engineer and Microsoft Certified Professional

The Microsoft Certified Systems Engineer (MCSE) is one of seven certification tracks in the Microsoft Certified Professionals Program (see URL below). MCSEs operate in a range of environments using the Microsoft Windows 2000 platform and Microsoft server software. After passing one exam in the MCSE track, an individual is awarded the entry-level Microsoft Certified Professional (MCP) designation.

Requirements for the MCSE are as follows:

1. Take five core exams and meet passing criteria.
2. Take two elective exams in supporting areas.

The cost of the exam is $400 for core and $200 for elective exams. Testing format is three computer-based multiple choice formats — short form (30 items, 60 minutes), long form (50 to 70 items, 90 minutes), and adaptive testing form (15 to 25 items, 60 minutes).

Microsoft authorized training centers are available to prepare a registrant for certification. Many community colleges and adult education programs provide this instruction. Educational training costs are approximately $300 to $450 per day. To complete the training, costs could total from $5,000 to $12,000. The tests can be taken without attending a training program. Alternate training methods may be used.

Microsoft made significant changes to the MSCE exam to protect test security, retain its validity, and meet organizations' technical needs. Microsoft eliminated the MCP + Internet certification when it retired its Windows NT 4.0 exam on December 21, 2000.

For more information on Microsoft and the MCSE certification, visit the Discovering Computers 2002 Apply It Web page(**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #3.

APPLY IT!

Certified Computing Professional

The recipient of the Certified Computing Professional (CCP) from the Institute for Certification of Computing Professionals (ICCP) has demonstrated a broad understanding of the computer as a business tool (see URL below). The knowledge base includes data resource management, communications and business information systems, fundamental principles of system security, office information systems, microcomputing and networks, programming development and software design, programming skills in two languages, such as BASIC and COBOL, and software engineering. The certification is not vendor specific; test takers are allowed to select from approximately 20 specialty areas, the more popular being management and systems development.

Requirements for the CCP certification are as follows:

1. Apply with ICCP for test authorization and take the tests within 90 days.
2. Take the Core exam and two specialty exams and pass with scores of 70 percent or better.
3. Meet the 48-month full-time work in computer-based information systems experience requirement.
4. Sign a document agreeing to comply with the ICCP Code of Ethics.
5. Pay an ICCP membership fee of $50.

CCPs can renew certification every 3 years and receive 120 hours of continuing education (CE) credit during the 3-year period. The cost of the exam is $195 per test, and testing format is computer-based multiple choice. Each test contains 110 items. The tests can be taken without attending a training program. ICCP offers training guides. Training resources are available through the ICCP Education Foundation. In addition to the CCP, the organization also sponsors a second entry-level certification, the Associate Computing Professional (ACP), requiring only the Core IT Skill exam and one specialty exam.

For more information on the CCP, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #4.

If you are interested in writing application programs, you also may benefit from certifications in networking and Web design. These certifications are tied closely to programming and broaden employment opportunities.

The table shown in Figure 16-21 represents a few of the certifications available in the programming area. People in the following jobs may be interested in a certification in programming:

- ActiveX, Perl, or Java programmers
- Network administrators
- Oracle database managers
- Programming consultants
- SQL programmers
- Web page designers

Hardware Certifications

The IT industry recognizes that knowledge of the hardware and the controlling software is necessary to set up, maintain, and repair a computer. Hardware certifications may vary in scope from a narrow focus with an emphasis on the repair of a specific device to an integrated hardware solution that addresses a company's current and future computing needs. Obtaining an advanced certification in hardware implies that you have achieved a standard of competence in assessing a company's hardware needs, and you can implement solutions to help the company achieve its computing goals.

If hardware is your forte, you also may benefit from networking and operating system software certifications. These certifications are tied closely to advanced hardware knowledge.

The table in Figure 16-22 represents a few available hardware certifications. People in the following careers may be interested in hardware certification:

- Cable installation technicians
- Personal computer consultants
- Personal computer field technicians
- Personal computer help desk specialists
- Personal computer repair technicians
- Personal computer trainers
- System engineers and administrators
- Technology coordinators

Networking Certifications

Professionals with the know-how to design, administer, and maintain a network are rewarded for their skills. MCSE, CCIE, and CNE certification holders with successful networking experience typically earn between $60,000 and $80,000. With multiple certifications and more experience, the networking professional may command a six-digit salary.

PROGRAMMING

Sponsor and Certifications	URL
IBM IBM Certified Developer Associate IBM Certified Specialist	ibm.com/education/certify
Microsoft Microsoft Certified Solution Developer (MCSD) Windows 2000 MCSE	microsoft.com/train_cert
Sun Certified Java Programmer Certified Java Developer Sun Certified Architect for Java Technology	suned.sun.com

Figure 16-21 Web sites for programming certifications.
For an updated list of training centers, visit scsite.com/cert.htm.

HARDWARE

Sponsor and Certifications	URL
Computing Technology Industry A+	comptia.com
International Business Machines (IBM) IBM Certified Professional Server Specialists (PSS)	ibm.com/education/certify
National Association of Communication System Engineers (NACSE) Associate and Senior Network Specialist Technician (NNT)	nacse.com

Figure 16-22 Web sites for hardware certifications.
For an updated list of training centers, visit scsite.com/cert.htm.

APPLY IT!

Sun Certified Programmer for the Java 2 Platform

In 1995, Sun introduced Java Technology, which became the first universal software platform designed from the ground up for the Internet and corporate intranets. A multivendor collaboration with Sun, IBM, Novell, and Sun-Netscape resulted from the expansion of the Certification Initiative for Enterprise Development. These companies agreed to establish a common certification for Java training to help address personnel shortages and assure a common platform for applications. Sun offers several certifications in Java and networking.

Receiving Sun Certified Programmer (SCP) certification indicates a programmer can create sophisticated Java applets; call Java applets from HTML (hypertext markup language); create a minimal TCP/IP server and client that communicates through sockets; generate simple and complex stand-alone applications and multithreaded programs; utilize GUI components, as well as simple and complex graphics; and use streams to read and write data and text files (see URL below).

Requirements for the SCP certification are as follows:

1. Purchase test voucher (good for one year) from Sun Educational Services.
2. Take one exam and pass with a score of 71 percent or higher.

The cost is $150 per test, and testing format is computer-based multiple-choice and short answer; 59 questions; 2 hours.

Sun Educational Services provides three types of courseware for its SCP certification: instructor-led training, self-paced training, and Web seminars. The instructor-led Java Programming Language is a five-day course. Other independent training companies may become Sun authorized training sites, and they often charge for classes on a daily basis. Sun also provides a self-paced CD-ROM course, JavaTutor, and a 30-day Java Programming Language Bundle on the Internet.

For more information on Sun Educational Services and the SCP certification, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #5.

APPLY IT!

A+ Certification

The A+ Certification, sponsored by Computing Technology Industry Association (CompTIA), is designed to affirm the competency level of computer repair technicians (see URL below). A+ certification indicates the IT professional has obtained a knowledge of PC setup, configuration, maintenance, troubleshooting, and system software that meets industrial standards. Certification indicates technicians have at least six months experience in the field. A+ certification integrates concepts with common setup and maintenance problems in the Windows and DOS environments.

Requirements for the A+ certification are as follows:

1. Take two tests, Core and DOS/Windows Operating Systems, and pass with scores of 65 to 66 percent or better.
2. Must take the tests within 90 days of each other.

The cost is $128 per test, and the testing format is computer-based multiple choice; 69 item core, 70 item operating system.

CompTIA provides curriculum objectives. Independent computer training centers use the objectives supplied by CompTia to develop A+ training programs. Prices for these programs may range from $700 to $1,400, depending on course length. The tests can be taken without attending a training program. CompTIA is a computer industry association established in 1982. Additional certification areas CompTIA offers include Certified Document Imaging Architect, Network+, and I–Net+. The I-Net+ is the newest certification sponsored by CompTIA and already has received the endorsement of major software companies.

For more information on the A+ certification, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #6.

APPLY IT!

Cisco Certified Internetworking Expert

The CCIE, sponsored by Cisco Systems, is one of the more valued certifications today (see URL below). A CCIE certifies an individual is qualified to work with Internetworking technologies and protocols at very complex levels. The CCIE certificate is valuable to both network and Internet experts. CCIEs specialize in one of three areas: WAN Switching, ISP-Dial, or Routing and Switching. Cisco places a high emphasis on experience by requiring a comprehensive hands-on laboratory examination that requires considerable knowledge to pass. Although not required, candidates first may qualify for the lower-level certifications before receiving the CCIE certification.

Requirements for the CCIE certification are as follows:

1. Take the CCIE exam and pass with a score of 70 percent or better.
2. After passing the written exam, pass a two-day, hands-on laboratory examination.

Recertification is available by completing authorized classroom training and passing one recertification examination every two years. The cost of the test is $100 to $200 for the written exam, and $1,000 plus travel expenses for the hands-on exam. The testing format is computer-based multiple choice (2 hours) and hands-on laboratory. Authorized training centers are available to prepare for certification. Educational costs range from $150 to $1,400 per class. Total training costs are reported from $10,000 to $30,000. The tests can be taken without attending a training program. Alternate training methods may be used.

Cisco Systems is a leading manufacturer of networking hardware and Internet solutions. The company controls over 80 percent of the networking router market. Because the system is highly proprietary, Cisco certifications are in high demand. Additional certifications offered by Cisco include Cisco Certified Networking Associate (CCNA), Cisco Certified Networking Professional (CCNP), Cisco Certified Design Associate (CCDA), and Cisco Certified Design Professional (CCDP).

For more information on Cisco Systems and CCIE certification, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #7.

APPLY IT!

Certified Novell Engineer

The Certified Novell Engineer (CNE), sponsored by Novell Corporation was the first vendor-sponsored certification and is a highly recognized credential (see URL below). A candidate earning the CNE demonstrates in-depth knowledge of the Novell network system. A CNE selects one of five specialization areas associated with a high level of networking knowledge. These skills include administration, design, configuration, and implementation of NetWare or GroupWare. The Certified Novell Administrator (CNA) is a stepping stone credential earned by taking one exam on the path to the CNE.

Requirements for the CNE certification are as follows:

1. Take one core exam and pass with a score of 75 percent or better.
2. Take five additional specialization exams.
3. All exams must be taken within a one-year time frame.

Recertification is renewed periodically by meeting Continuing Certification Requirements. The cost of the test is $95 per exam, and the testing format is computer-based multiple choice or adaptive testing; 63 to 73 items per test.

Authorized training centers are available to prepare for certification. Educational costs range from $300 to $400 per day. The tests can be taken without attending a training program. Alternate training methods may be used.

For more information on the Novell Corporation and CNE, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #8.

NETWORK

Certifications	URL
Cisco Cisco Certified Network Professional (CCNP) Cisco Certified Internetwork Expert (CCIE)	cisco.com/certification
Computing Technology Industry Network +	comptia.com
Microsoft Microsoft Certified Systems Engineer (MCSE)	microsoft/train_cert
Novell Certified Novell Associate (CNA) Certified Novell Engineer (CNE)	education.novell.com

Figure 16-23 Web sites for network certifications.
For an updated list of training centers, visit scsite.com/cert.htm.

Network expertise is acquired through years of experience and training because so many variables exist for a total network solution. Obtaining an advanced certification in networking implies that you have achieved a standard of competence, enabling you to address the complex issues that arise when planning, installing, managing, and troubleshooting a network.

The table shown in Figure 16-23 represents a few of the certifications available in the network area. People in the following careers may be interested in network certification:

- Hardware service technicians
- Help desk personnel
- Network consultants
- Network managers
- Networking engineers
- System administrators

Internet Certifications

A variety of Internet certification tracks are available. Some of these certifications are hardware based. They cover technology often used by an Internet service provider or for a large company developing an intranet system. These certifications are demanding and require technical expertise in networking hardware and configuration before enrollment in the training program. Web management and Web programming certifications also are among the tracks. Certification in these tracks are for people interested in designing, implementing, and maintaining Web sites. Web development certifications also are demanding. Success in the field requires special resources, including an aptitude for programming, marketing and graphic design skills, a customer service-oriented attitude, and good communications skills.

If you are interested in working in an Internet-related occupation, you can benefit from certifications in hardware, networking, operating systems, and programming. These certifications are tied closely to the Internet and broaden your opportunities to acquire Internet and Internetworking knowledge quickly.

The table shown in Figure 16-24 represents a few of the certifications available in the Internet area. People in the following careers may be interested in Internet certification:

- Internet and intranet managers
- Internet service provider staff
- Java, Perl, or ActiveX programmers
- Network administrators
- Web page designers
- Webmasters

INTERNET

Certifications	URL
Cisco Cisco Certified Internetwork Expert (CCIE)	cisco.com/certification
International Webmasters Association Certified Web Professional (CWP)	irwa.org
Microsoft MCSE + Internet	microsoft.com/train_cert
Novell Certified Internet Professional	education.novell.com
ProsoftTraining.com Certified Internet Webmaster (CIW)	ciwcertified.com

Figure 16-24 Web sites for Internet certifications.
For an updated list of training centers, visit scsite.com/cert.htm.

COMPANY ON THE CUTTING EDGE

RealNetworks

Delivering Multimedia Content

Imagine having 200,000 new users visit your home page each day! That is the success RealNetworks has experienced with its RealPlayer®, amounting to a 300 percent growth since 1998. The RealNetworks family of Web sites is one of the 20th most popular Internet destinations. RealPlayer also is the fourth most popular application among United States' home users, according to Media Metrix. No wonder *PC Magazine* ranks the company 15th on its list of the 100 most influential companies in the world.

More than 400,000 companies rely on RealNetworks' software to deliver audio, video, and other multimedia services to personal computers and other electronic devices. Despite continued competition, RealNetworks' formats are used in 85 percent of Web pages using streaming media.

Founder Rob Glaser introduced the first version of RealAudio in 1995, and his company has set the standard for sending multimedia content across the Internet. Today, the two most popular products are RealPlayer and RealJukebox. RealPlayer, released in 1995, has more than 160 million unique registered users. RealJukebox is the favorite music jukebox system among U.S. listeners, with 50 million unique registered users. In addition, more that 2,500 live radio stations and broadcasters rely on RealAudio to deliver live sports, music, news, and entertainment.

For more information on RealNetworks, visit the Discovering Computers 2002 Companies Web page (**scsite.com/dc2002/companies.htm**) and click RealNetworks.

APPLY IT!

Certified Internet Webmaster

The Certified Internet Webmaster (CIW) Internet certification program, sponsored by ProsoftTraining.com, targets Internet professionals who plan, produce, manage, maintain, and provide Web presence security (see URL below). Foundations, a Level 1 certification, introduces the Web as a commerce opportunity. Level 2 contains seven specialty areas. Each area represents a role in the Internet industry. The certifications are Site Designer, Application Developer, Enterprise Developer, Server Administrator, Internet-working Professional, Security Profes-sional, and E-Commerce Professional.

Requirements for the CIW Certification are as follows:

1. Take the CIW Foundations test and pass it with a score of 75 percent or better.
2. After passing the Level 1 test, take any Level 2 specialty certification exam.

The cost of the test is $100, and the testing format is computer-based multiple-choice.

ProsoftTraining.com offers the Prosoft Certified Training Center (PCTC) partnership and educational materials to resellers and independent computer training centers. The complete CIW Level 1 and Level 2 certification is a 55-day curriculum and has a cost of approximately $500 per training day. The tests can be taken without attending a training program. Alternate training methods may be used.

ProsoftTraining.com is an Internet-solutions company committed to providing instructor-led curriculum for comprehensive Internet skills and vendor-neutral certification to obtain Internet skills. In addition to the CIW program, ProsoftTraining.com provides a certification for Linux and UNIX Administration and training courses and educational materials for CompTIA's Network+ and I-Net+ certification. ProsoftTraining.com offers more than 50 instructor-led Internet skills courses that range from one-day end-user workshops to 10-day certification programs.

For more information on ProsoftTraining.com certification and its Web site, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #9.

Database Systems Certifications

Supporting a large database management system requires a professional staff. The job roles the staff assumes are a core around which the database management certifications are based. If you are interested in working with a database management system, you also may benefit from certifications in hardware, Internet, networking, and programming.

The table shown in Figure 16-25 represents a few of the certifications available in the database systems area. People in the following careers may be interested in database certification:

- Database administrators
- Database analysts
- Database application developers
- Database designers
- Database specialists

CERTIFICATION BENEFITS

When it comes to certification, organizations send IT professionals a clear message: certifications offer many benefits to companies and employees. IT certification can enhance employees' careers and provide them with a better standing as industry professionals. As shown in Figure 16-26, a salary survey

APPLY IT!

Oracle Certified Database Administrator

The DBA certification, sponsored by the Oracle Corporation identifies the skills necessary for setting up, maintaining, diagnosing, and troubleshooting Oracle databases in a networked or non-networked environment (see URL below). It also indicates knowledge of security systems and data access, auditing, and backup. This certification assumes that candidates have at least six months of database administrative experience before taking the exam.

Requirements for the DBA are as follows:

1. Take 4 or 5 exams (depending on the track selected) and pass with scores of 75 percent or better.

The cost of the exams is $125 each, and the testing format is computer-based multiple-choice; 60 to 65 items, 90 minutes.

Authorized training centers are available to prepare for certification. Educational costs are $8,200 for a five-exam training package. The tests can be taken without attending a training program. Alternate training methods may be used.

The Oracle database product line has become one of the more respected database management products in the computer industry. It is designed for portability and can be used in network, intranet, and Internet environments.

For more information on the Oracle Corporation and the DBA certification, visit the Discovering Computers 2002 Apply It Web page (**scsite.com/dc2002/apply.htm**) and click Chapter 16 Apply It #10.

DATABASE

Sponsor and Certifications	URL
IBM IBM Certified Solutions Expert DB2 UDB V6.1 IBM Database Administration for UNIX, Windows, and OS/2	ibm.com/education/certify
Informix Informix Certified Database Specialist	informix.com/informix/training
Microsoft Microsoft Certified Database Administrator (MCDBA)	microsoft.com/training_cert
Oracle Application Developer, Oracle Developer Release 1 Track	education.oracle.com/certification
Sybase Certified Sybase Professional – Database Administrator (CSP-DBA)	slc.sybase.com/certification

Figure 16-25 Web sites for database systems certifications.
For an updated list of training centers, visit scsite.com/cert.htm.

conducted by Microsoft reported that more than one-half of the respondents had a salary increase due to certification, with 13 percent of these workers reporting significant raises of more than 25 percent. Many job listings ask for specific skills represented by certifications, and the number of companies requiring these skills is expected to continue growing in the future. Figure 16-27 describes three benefits derived from certification.

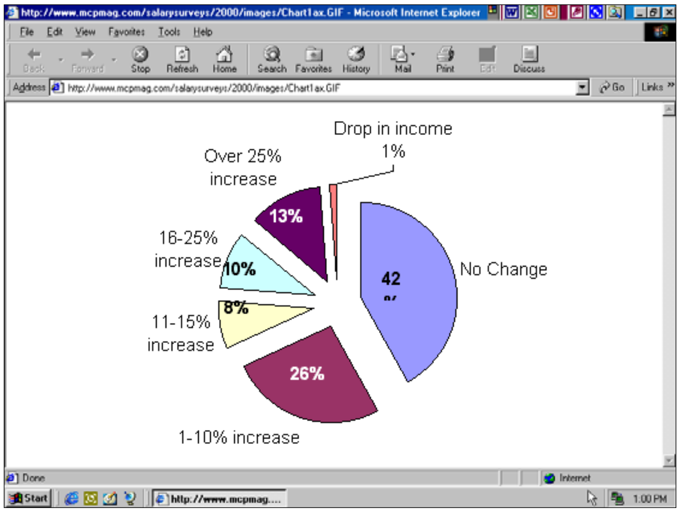

http://www.mcpmag.com/salarysurveys/2000/images/Chart1ax.GIF - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://www.mcpmag.com/salarysurveys/2000/images/Chart1ax.GIF
Go Links
Drop in income 1%
Over 25% increase
13%
16-25% increase
10%
11-15% increase
8%
26%
1-10% increase
42%
No Change
Done
Internet
Start
http://www.mcpmag....
1:00 PM

Figure 16-26 Microsoft's Fifth Annual Salary Survey of Microsoft Certified Professionals shows that certification can increase salary.

BENEFITS OF CERTIFICATION

Benefit	Description
Career	Certification accomplishments are one of the first listings an employer notices on a resume. Certification provides a benchmark, or a means to measure a person's skills. It can set an individual apart from other potential candidates who may be vying for a similar advancement or position. Often a professional studies and takes training to move into another area of the computer industry. Even for those not currently looking for a career change, certification can serve as insurance.
Professional	Certification is a personal achievement that adds credibility among peers and employers. To identify certified individuals, sponsors award certificates of accomplishment. Certification also authorizes the person to use the product's official logo or symbol on items, such as business cards and Web pages. These emblems represent a person's skills and knowledge in a concise form. As an additional bonus, some certification training can be used for college credit.
Salary	Numerous salary surveys have shown that certification is one of the top factors influencing raises. Companies often pay a bonus as an incentive for certification. Individuals with more than one area of expertise can command even higher salaries.

Figure 16-27 Employees benefit from computer certification in three major ways.

ISSUE

Marketing Strategy or Product Support?

Vendor-Specific Certification

Some feel a self-created demand exists for certain vendor-specific certifications based on brand-name association. Vendors may sponsor a number of certifications to gain industry recognition. Occasionally vendors even require resellers employ a certain number of certified individuals. In addition, certifications are used as major moneymakers in their own right. Training has grown into a major part of the computer industry, with tuition costing thousands of dollars.

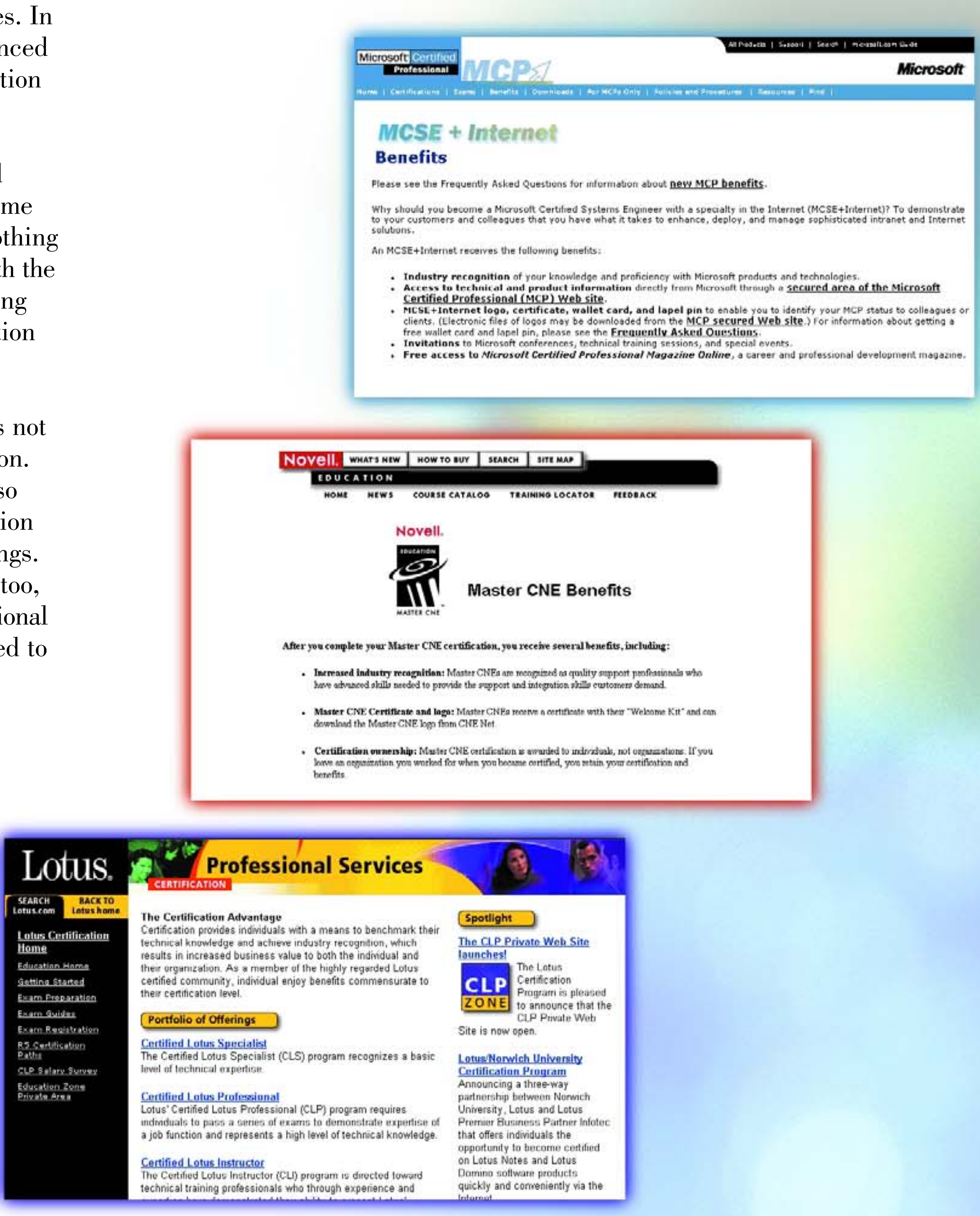
On the other hand, each particular computer product has unique features that are not covered in a general examination. Vendor-specific certifications confirm a professional knows the distinctive details of a particular system. Computer products also undergo continual updates. To ensure certified individuals have up-to-date knowledge, vendors constantly modify the examinations to reflect the latest alterations in their product technology. Should certificate holders be required to renew their certification frequently? How often? Should they be required to review for each product update? Should the sponsoring company offer a price break for certification updates?

For more information on the vendor-specific certification, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 16 Issue #3.

Vendor-sponsored certifications offer many special benefits as incentives. As shown in Figure 16-28, vendors often provide special privileges to certified professionals, such as access to technical and product information. This may include access to secure online electronic resources, special technical support, automatic notification of updates, and access to **beta products** — those still in the testing stage — and early releases. In addition, vendors may offer advanced training opportunities to certification holders. Free vendor magazine subscriptions and discounts on product-support publications and tools sometimes are available. Some vendors even have authorized clothing lines with T-shirts embellished with the certification logo. Although nothing guarantees job security, certification helps to give the IT professional peace of mind.

The certified professional is not the only beneficiary of certification. As mentioned earlier, vendors also benefit from the product recognition and support that certification brings. Employers and customers profit, too, for they know they hired a professional with the training and skills needed to work on their particular system.

Professional organizations, such as the Institute for Certification of Computer Professionals (ICCP), establish standards to raise the competence level for the computer industry. Certification beneficiaries are described in Figure 16-29.


Microsoft Certified Professional
MCP
Microsoft
All Products | Support | Search | microsoft.com Guide
Home | Certifications | Exams | Benefits | Downloads | For MCPs Only | Policies and Procedures | Resources | Find |

MCSE + Internet

Benefits

Please see the Frequently Asked Questions for information about new MCP benefits.

Why should you become a Microsoft Certified Systems Engineer with a specialty in the Internet (MCSE+Internet)? To demonstrate to your customers and colleagues that you have what it takes to enhance, deploy, and manage sophisticated intranet and Internet solutions.

An MCSE+Internet receives the following benefits:

- **Industry recognition** of your knowledge and proficiency with Microsoft products and technologies.
- **Access to technical and product information** directly from Microsoft through a secured area of the Microsoft Certified Professional (MCP) Web site.
- **MCSE+Internet logo, certificate, wallet card, and lapel pin** to enable you to identify your MCP status to colleagues or clients. (Electronic files of logos may be downloaded from the MCP secured Web site.) For information about getting a free wallet card and lapel pin, please see the Frequently Asked Questions.
- **Invitations** to Microsoft conferences, technical training sessions, and special events.
- **Free access to *Microsoft Certified Professional Magazine Online***, a career and professional development magazine.

Master CNE Benefits

After you complete your Master CNE certification, you receive several benefits, including:

- **Increased industry recognition:** Master CNEs are recognized as quality support professionals who have advanced skills needed to provide the support and integration skills customers demand.
- **Master CNE Certificate and logo:** Master CNEs receive a certificate with their "Welcome Kit" and can download the Master CNE logo from CNE Net.
- **Certification ownership:** Master CNE certification is awarded to individuals, not organizations. If you leave an organization you worked for when you became certified, you retain your certification and benefits.

The Certification Advantage
Certification provides individuals with a means to benchmark their technical knowledge and achieve industry recognition, which results in increased business value to both the individual and their organization. As a member of the highly regarded Lotus certified community, individual enjoy benefits commensurate to their certification level.

Portfolio of Offerings

Certified Lotus Specialist
The Certified Lotus Specialist (CLS) program recognizes a basic level of technical expertise.

Certified Lotus Professional
Lotus' Certified Lotus Professional (CLP) program requires individuals to pass a series of exams to demonstrate expertise of a job function and represents a high level of technical knowledge.

Certified Lotus Instructor
The Certified Lotus Instructor (CLI) program is directed toward technical training professionals who through experience and

Spotlight

The CLP Private Web Site launches!
The Lotus Certification Program is pleased to announce that the CLP Private Web Site is now open.

Lotus/Norwich University Certification Program
Announcing a three-way partnership between Norwich University, Lotus and Lotus Premier Business Partner Infotec that offers individuals the opportunity to become certified on Lotus Notes and Lotus Domino software products quickly and conveniently via the

Figure 16-28 Sponsors offer a variety of benefits to certificate holders.

CHOOSING A COMPUTER CERTIFICATION

With certification, one size does not fit all. Just as all computers are not alike inside the box, all certifications are not the same when it comes to training and options. Selecting a certification is a personal process that requires careful thought and research. If you are considering obtaining a certification, reflect on your career goals and interests. Consider your career path during the long term. Then, assess your background knowledge and experience.

Finally, research certifications to find those that best match your needs. Figure 16-30 describes factors to consider. If you are new to the computer field, it is best to start with a general, entry-level certification.

BENEFICIARIES OF CERTIFICATION

Benefit	Description
Customers	Customers are becoming aware of the benefits of certification. They gain confidence when the IT professional has earned a certification. Multiple certifications show the professional can deal with many aspects of a problem, using several areas of expertise. As an added benefit, certification implies motivation to expend extra effort to go beyond basic job requirements.
Employers	An industry-sponsored study indicates certified workers are more productive and knowledgeable than non-certified employees. Certified help desk technicians are able to handle more support calls. Companies with certified personnel experience less network downtime. As an added bonus, end users are more satisfied with the company's work, and the professional employees within the company have higher morale and job contentment. Certification is an incentive for employees to upgrade their skills continuously.
Industry	Certification is a form of industry self-regulation. It sets computer professionals' competence standards and raises the level of expertise and knowledge in the IT industry as a whole. This, in turn, enhances the reputation of the professionals within the industry. As more people become certified, the industry professionals are perceived as reliable and capable support for the computers on which society has come to rely.

Figure 16-29 Certification benefits extend beyond the certified individual.

Web Link

For more information on loans, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Loans.

FACTORS TO CONSIDER IN SELECTING A CERTIFICATION

- Consider the expenses and the time involved to obtain the certification.
- Examine employment projections.
- Look at job listings to see what skills currently are needed.
- Read evaluations of certifications.
- Talk to people in the industry.
- Think about complementary combinations of certifications to meet your goals.

Figure 16-30 Factors in selecting a certification.

Otherwise, you may wish to choose a certification that has immediate benefits for your current job. Alternately, consider building on your existing experience with a certification that helps to reach your career goals. A certification represents a major commitment in time and money. Thoughtful research and planning can serve to guide your career to your chosen destination.

ISSUE

Certification Versus Experience

Substituting Certification for Experience

New contenders entering the IT industry often use certification to jump-start their careers. Although certification cannot replace job experience, most employers today look at a certification as a complement, not a replacement, to experience. Certification is an objective measurement of achievement. It represents a knowledge- and skill-base a person can draw on to perform a job. IT training is not mandatory. Neither is college. As with college, however, IT certification can take a career to new heights. Certification cannot replace the decision-making and troubleshooting skills gained through experience, but it can open doors to employment and help gain advancement for those already employed. Can certification help someone become a successful employee? How important are certifications without experience? Will IT certified specialists continue to be in high demand?

For more information on the value of certification, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 16 Issue #4.

PREPARING FOR COMPUTER CERTIFICATION

Most certification programs do not require academic coursework. Test results determine certification entirely. Very few professionals, however, have the experience and skill set to take a certification exam without preparation. Most people prefer to follow a study program to prepare for the test. Even with experience, study serves as a review and may help to fill gaps in knowledge.

Training options are available to suit every learning style. You can study on your own using a variety of educational materials, including those available from online suppliers. Or you can take online training classes. A third option is to select an instructor-led class to guide you through the training process. In addition, the Internet contains many resources. Most people prefer to use a combination of these options, which are described in the table in Figure 16-31. Figure 16-32 shows Web sites for many of these training methods.

CERTIFICATION STUDY PROGRAMS

Method	**Description**
Self-Study	Flexible self-study programs help professionals prepare for certification at their own pace and supplement other training methods. Self-study requires high motivation and discipline, but many people like the convenience of setting their own pace while studying at home or in the office. Although self-study is the least expensive option, it can be the most time-consuming. Hundreds of books, workbooks, videotapes, and computer-based training packages on CD-ROM or disk are available.
Online Training Classes	Many online training classes are available on the Internet and by many companies that have set up intranets to provide online training within their organizations. Online training allows students to set their own pace in an interactive environment and combines the technological advantages of computer-based training with the connectivity of the Internet. Some programs allow students to take certification examinations online. Online programs can cost approximately one-third the price of the traditional instructor-led programs.
Instructor-Led Training	Estimates show that 80 percent of all certification preparation is classroom-based. Instructor-led training is available in a variety of forms, including seminars, which traditionally are held for several days within the span of one week; boot camps, which immerse students in intensive coursework for up to two weeks; and academic-style classes, which span a period of several weeks or months. Some sponsors operate their own training sessions and also authorize independent training centers.
Web Resources	The certification sponsor's Web site generally contains descriptions of the available certifications, with frequently asked questions (FAQ) and links to authorized training and testing centers. Many sites include detailed course objectives, training guides, and sample test questions. Some sponsors have online resources to help you plan and track your training program. Most sell books and other training resources. Many sites offer practice test sessions, chat rooms, and discussion groups. Individuals often set up sites to offer their own views and tips on the testing process.

Figure 16-31 Study programs help professionals prepare for certification examinations.

COMPUTER CERTIFICATION EXAMINATIONS

Authorized testing companies, such as Sylvan Prometrics (sylvanprometric.com), Virtual University Enterprises (vue.com), and e-certifications (tekmetrics.com) provide most certification exams. Certification sponsors often have a link to the testing company's site from their own Web page. At the training company's site, you can use the test center locator to find a list of centers near you. The list includes addresses and telephone numbers. Most companies enable you to pay for the test either online or by telephone with a credit card. On the day of the test, you must present two forms of identification, one of which is a photo identification.

At the testing centers, examinations are taken using computers. These systems process the results as you take a test; you will know immediately whether you pass the examination. Most tests are in a multiple-choice format. Figure 16-33 shows a sample of the types of questions that appear on a certification exam. A new technique known as

TRAINING WEB SITES

Online Suppliers	**URL**
Amazon.com	amazon.com
Barnes and Noble	b&n.com
computerprep.com	computerprep.com
Fatbrain	fatbrain.com
VCSS – Virtual Computer Super Store	vcss.com
Online Training	**URL**
CyberState University at Bad Dog's Training Planet	trainingplanet.com
DigitalThink	digitalthink.com
Learning Tree International	learningtree.com
Magellan University	magellan.edu
Instructor-Led Training	**URL**
Global Knowledge	globalknowledge.com
New Horizons	newhorizons.com
The Institute for Technology Training and Excellence (ITTE)	itte.org
Virtual University Enterprises (VUE)	vue.com/training
Study Resources	**URL**
Cramsession	cramsession.com
gocertifiy.com	gocertify.com
mcsetutor.com	mcsetutor.com
The Mining Company	certification.miningco.com

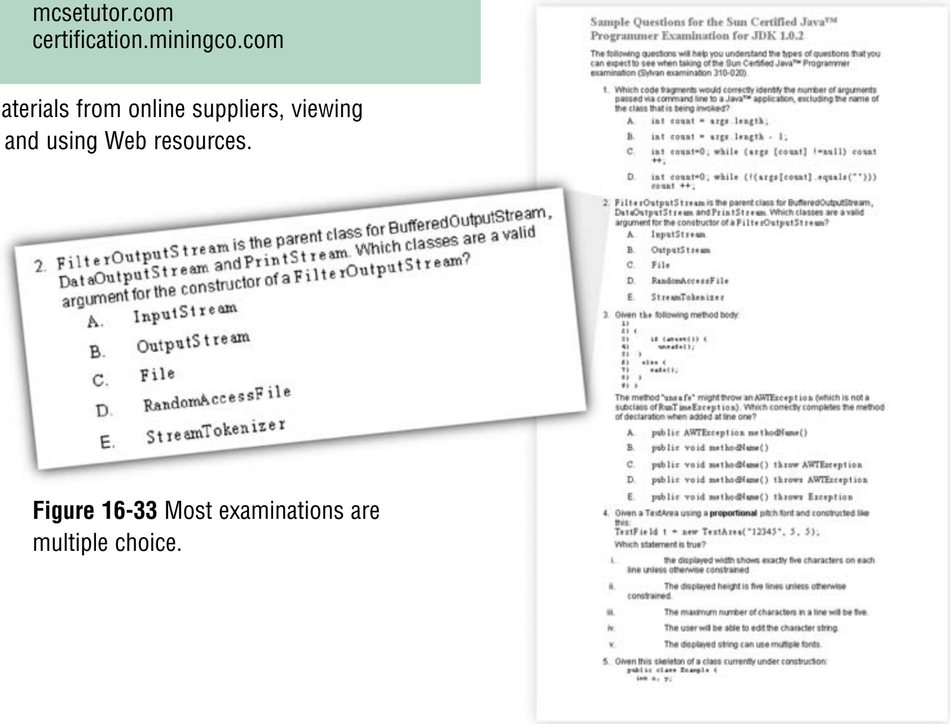
Figure 16-32 Study options include obtaining materials from online suppliers, viewing online training, attending instructor-led training, and using Web resources.

Web Link

For more information on self-study, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Self-Study.

Web Link

For more information on instructor-led training, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Instructor-Led Training.



Sample Questions for the Sun Certified Java™ Programmer Examination for JDK 1.0.2

The following questions will help you understand the types of questions that you can expect to see when taking of the Sun Certified Java™ Programmer examination (Sylvan examination 310-020).

1. Which code fragments would correctly identify the number of arguments passed via command line to a Java™ application, excluding the name of the class that is being invoked?
   A. `int count = args.length;`
   B. `int count = args.length - 1;`
   C. `int count=0; while (args [count] !=null) count ++;`
   D. `int count=0; while (!(args[count].equals(""))) count ++;`
2. `FilterOutputStream` is the parent class for BufferedOutputStream, `DataOutputStream` and `PrintStream`. Which classes are a valid argument for the constructor of a `FilterOutputStream`?
   A. `InputStream`
   B. `OutputStream`
   C. `File`
   D. `RandomAccessFile`
   E. `StreamTokenizer`
3. Given the following method body:

```
1)
2) {
3)     if ([illegible]) {
4)       unsafe();
5)  }
6)   else {
7)     safe();
8)  }
9) }
```

The method "`unsafe`" might throw an `AWTException` (which is not a subclass of `RunTimeException`). Which correctly completes the method of declaration when added at line one?
   A. `public AWTException methodName()`
   B. `public void methodName()`
   C. `public void methodName() throw AWTException`
   D. `public void methodName() throws AWTException`
   E. `public void methodName() throws Exception`
4. Given a TextArea using a **proportional** pitch font and constructed like this:
`TextField t = new TextArea("12345", 5, 5);`
Which statement is true?
   i. the displayed width shows exactly five characters on each line unless otherwise constrained
   ii. The displayed height is five lines unless otherwise constrained.
   iii. The maximum number of characters in a line will be five.
   iv. The user will be able to edit the character string.
   v. The displayed string can use multiple fonts.
5. Given this skeleton of a class currently under construction:

```
public class Example {
  int x, y;
```

2. `FilterOutputStream` is the parent class for BufferedOutputStream, `DataOutputStream` and `PrintStream`. Which classes are a valid argument for the constructor of a `FilterOutputStream`?
A. `InputStream`
B. `OutputStream`
C. `File`
D. `RandomAccessFile`
E. `StreamTokenizer`

Figure 16-33 Most examinations are multiple choice.

computerized adaptive testing (**CAT**) may be used; these tests analyze a person's responses while taking the test. The number and order of the test questions are modified to correspond to each individual's progress and demonstrated ability. Occasionally, a certification requires a hands-on lab test. The certification sponsor typically administers these tests. These examinations are much more expensive than the traditional tests. In addition, the number of testing facilities is limited.

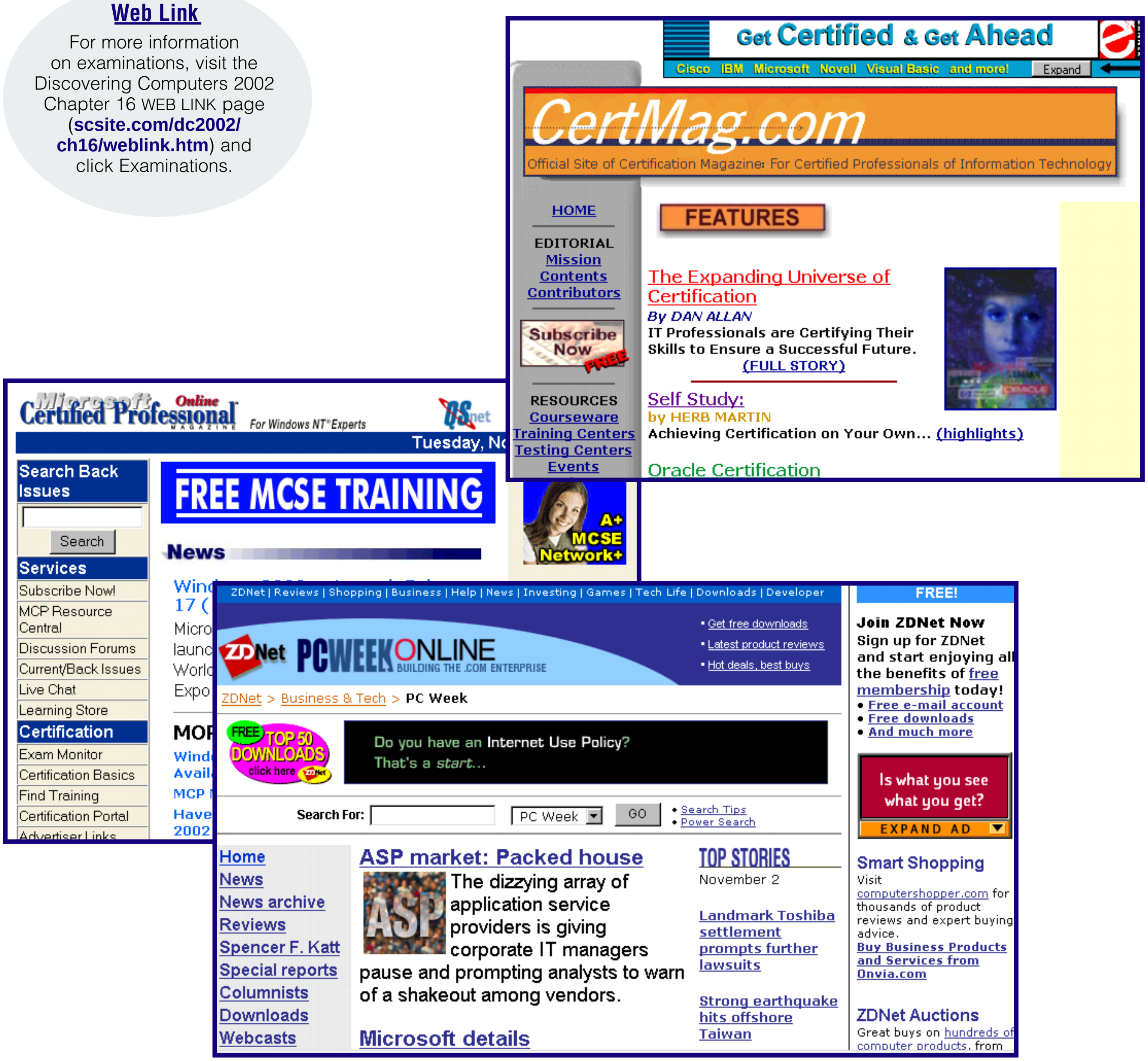
If you do not pass an exam, you must pay the fee again to retake the test. In some cases, you can retake the test immediately. Most people, however, opt to review before trying to take the test again. Some training centers offer a guarantee for their program. They provide discounts or even free sessions for individuals who have completed their program, yet do not pass a test. Most sponsors allow candidates a set time period, such as a year, in which to complete the test.

CAREER DEVELOPMENT AFTER COMPUTER CERTIFICATION

Knowledge is an endless quest for IT professionals. Professionals realize that to keep pace with this revolutionary industry, they must maintain and continually monitor technological developments. As shown in Figure 16-34, sponsors often provide restricted-access Web resources specifically for certificate holders.

Web Link

For more information on examinations, visit the Discovering Computers 2002 Chapter 16 WEB LINK page (**scsite.com/dc2002/ch16/weblink.htm**) and click Examinations.



Get Certified & Get Ahead
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Achieving Certification on Your Own... (highlights)
Oracle Certification

Microsoft Certified Professional Online MAGAZINE For Windows NT Experts
Tuesday, No
Search Back Issues
Search
Services
Subscribe Now!
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Discussion Forums
Current/Back Issues
Live Chat
Learning Store
Certification
Exam Monitor
Certification Basics
Find Training
Certification Portal
Advertiser Links
FREE MCSE TRAINING
A+ MCSE Network+
News
Wind
17 (
Micro
launc
World
Expo
MOR
Wind
Avail
MCP
Have
2002

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• Get free downloads
• Latest product reviews
• Hot deals, best buys
ZDNet > Business & Tech > PC Week
FREE TOP 50 DOWNLOADS click here
Do you have an Internet Use Policy? That's a start...
Search For: PC Week GO
• Search Tips
• Power Search
Home
News
News archive
Reviews
Spencer F. Katt
Special reports
Columnists
Downloads
Webcasts
ASP market: Packed house
The dizzying array of application service providers is giving corporate IT managers pause and prompting analysts to warn of a shakeout among vendors.
Microsoft details
TOP STORIES
November 2
Landmark Toshiba settlement prompts further lawsuits
Strong earthquake hits offshore Taiwan
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• Free e-mail account
• Free downloads
• And much more
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Smart Shopping
Visit computershopper.com for thousands of product reviews and expert buying advice.
Buy Business Products and Services from Onvia.com
ZDNet Auctions
Great buys on hundreds of computer products, from

Figure 16-34 Certified professionals have access to resources to help them maintain their skills.

Most certifications expire after a set time period because product-based skills remain current for only about 18 months. Sponsors specify training or examinations to maintain the certification. In addition, if a vendor issues a product update, certificate holders must retrain almost immediately.

CHAPTER SUMMARY

This chapter discussed the strong demand for computer and IT professionals and focused on the available careers, job preparation, and career development planning. Also included was information about certification preparation, examinations, and resources. Finally, career development after certification was discussed.

ISSUE

Testing Your Expertise

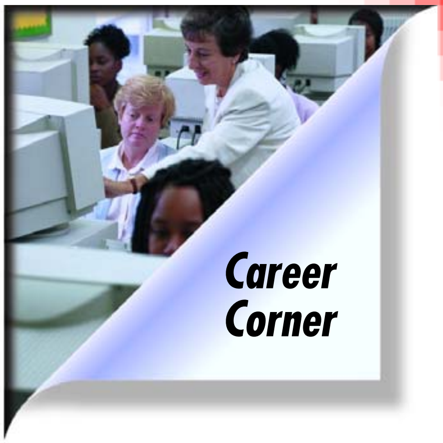
Certification Tests

Critics say that certification tests cannot truly measure a person's ability to work with actual computers. Certification tests are composed primarily of multiple-choice questions. The critics believe the tests do not reflect the multitude of real-world possibilities an individual might encounter.

Another concern is that individuals may study to pass the test, focusing on how to answer particular questions instead of gaining a broad knowledge of the field. Indeed, some Web sites post specific advice on passing the tests, based on information garnered from people who already have taken the tests. In addition, a few feel that some forms of training — where intense, short-term sessions culminate in an exam — rely on the accumulation of the collection of facts needed for short-term success instead of long-term skill development.

Certification sponsors are addressing these issues by continually improving the tests. Simulations and problem solving are used in the examinations to measure an individual's ability to work with a system. Can skills be measured by a multiple-choice question test? Should all certification tests include simulations and problem solving? Some sponsors now require individuals taking the tests to sign nondisclosure statements. Should someone have to sign these statements or should sponsors randomize and vary their tests? Adaptive testing techniques tailor a test to the individual being tested. This means that each person's testing experience is unique. Is this a more valid way of administering a test? Is it better than simulation? Or, should it be combined with simulation?

For more information on certification testing, visit the Discovering Computers 2002 Issues Web page (**scsite.com/dc2002/issues.htm**) and click Chapter 16 Issue #5.



Computer and IT Teachers

Computer and IT teachers are more in demand than ever. From K-12, to higher education, to business and corporate training, skilled teachers are being encouraged and enticed with many benefits and rewards not offered previously to teachers.

To teach in K-12 requires at least a bachelor's degree with some computer-related courses. Most higher education institutions require at least a master's degree with 18 graduate hours in the subject area. To teach software and/or hardware design generally requires a master's and/or a Ph.D. in engineering. Those looking to teach at the community college level or in technical schools, can take several teaching paths — from office applications and help desk to Internet development to programming to networking and even multimedia.

Qualifications for the corporate world are not quite so stringent as those for educational institutions. Many companies hire instructors with trainer certifications. Examples are the Microsoft Certified Trainer (MCT) and Cisco Certified Trainer. Distance learning management programs, such as WebCT, also are offering certification programs.

Salaries range widely. For those who work in a traditional educational setting, the salaries vary from around $30,000 to $60,000, depending on area of expertise, years of experience, and the state in which one works. In the corporate world, salaries are considerably higher, ranging from $35,000 to $80,000 or more.

To learn more about the field of computer and IT teacher as a career, visit the Discovering Computers 2002 Careers Web page (**scsite.com/dc2002/careers. htm**) and click Computer and IT Teacher.

E-ARTS E-LITERATURE

FIND SOME CULTURE

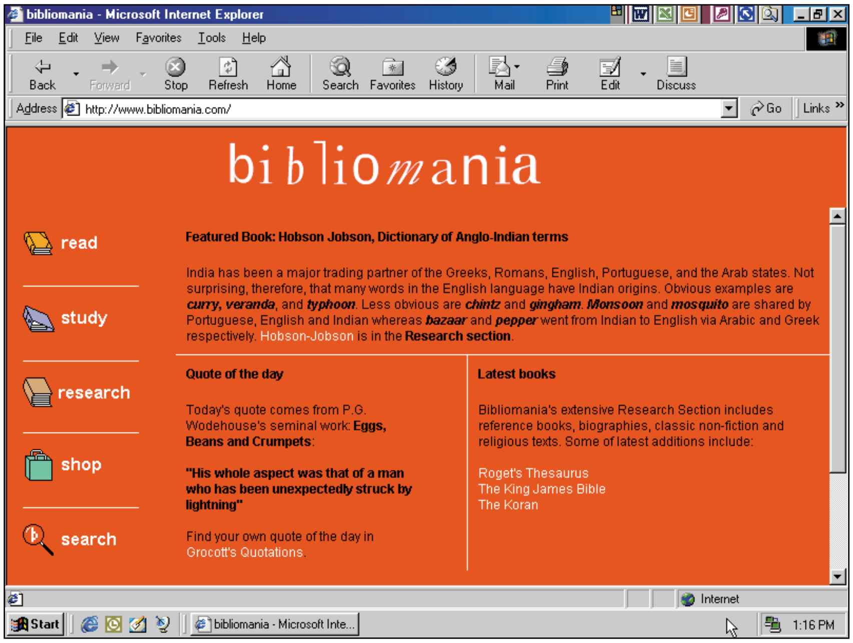
Get Ready to Read, Paint, and Dance

Brush up your Shakespeare. Start quoting him now. Brush up your Shakespeare. And the women you will wow. This refrain to one of the songs in Broadway's hit musical, Cole Porter's *Kiss Me Kate*, emphasizes the value of knowing the Bard of Avon's words. You can expand your knowledge of Shakespeare and other literary greats with a little help from the Internet.

For example, Shakespeare.com provides in-depth reviews and news of the world's most famous playwright and his works. The Gale's Literary Index Web site has a master index of the authors and titles of popular literature series, such as Shakespearean Criticism, Hispanic Writers, and Twentieth-Century Romance and Historical Writers. At the Fantastic Web Fiction site, you can peruse an online bibliography database of science fiction authors and book titles. The Electronic Literature Directory allows you to search for genres, titles, authors, and publishers.

The full text of hundreds of books is available online from the Bibliomania (Figure 16-35) and Project Gutenberg Web sites. If you are not keen on reading all of Dostoevsky's *Crime and Punishment* or Homer's *Iliad* on your desktop computer monitor, you can download these works to your e-book or handheld computer.

When you are ready to absorb more culture, you can turn to various art Web sites on the Internet. Many museums have images of their collections online. Among them are the J. Paul Getty Museum in Los Angeles, the Montreal Museum of Fine Arts (Figure 16-36), the Children's Museum of Indianapolis, and the Louvre Museum in Paris (Figure 16-37). Comprehensive glimpses of galleries, museums, and other



Featured Book: Hobson Jobson, Dictionary of Anglo-Indian terms

India has been a major trading partner of the Greeks, Romans, English, Portuguese, and the Arab states. Not surprising, therefore, that many words in the English language have Indian origins. Obvious examples are ***curry, veranda***, and ***typhoon***. Less obvious are ***chintz*** and ***gingham***. ***Monsoon*** and ***mosquito*** are shared by Portuguese, English and Indian whereas ***bazaar*** and ***pepper*** went from Indian to English via Arabic and Greek respectively. Hobson-Jobson is in the **Research section**.

Quote of the day

Today's quote comes from P.G. Wodehouse's seminal work: **Eggs, Beans and Crumpets**:

"His whole aspect was that of a man who has been unexpectedly struck by lightning"

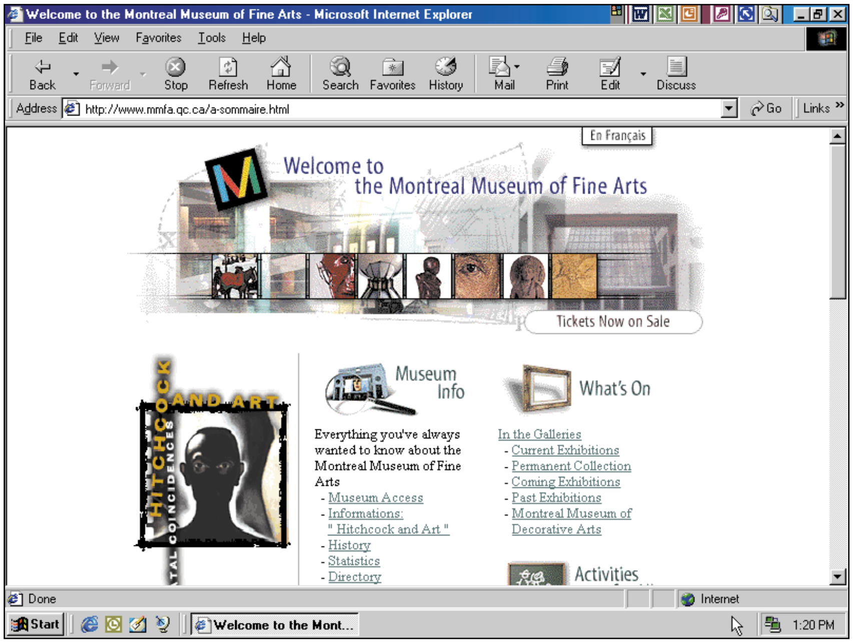
Find your own quote of the day in Grocott's Quotations.

Latest books

Bibliomania's extensive Research Section includes reference books, biographies, classic non-fiction and religious texts. Some of latest additions include:

Roget's Thesaurus
The King James Bible
The Koran

Figure 16-35 Classic fiction, short stories, drama, poetry, and dictionaries are available for viewing or dowloading from Bibliomania and other Web sites.



Everything you've always wanted to know about the Montreal Museum of Fine Arts
- Museum Access
- Informations: " Hitchcock and Art "
- History
- Statistics
- Directory

In the Galleries
- Current Exhibitions
- Permanent Collection
- Coming Exhibitions
- Past Exhibitions
- Montreal Museum of Decorative Arts

Figure 16-36 Permanent, temporary, and virtual exhibitions, educational activities, a boutique, and a bookstore are featured on the Montreal Museum of Fine Arts Web site.

cultural meccas throughout the world as well as paintings and sculptures are found on such Web sites as Absolutearts.com, and the Gallery Guide.

The Argus Clearinghouse, Access Place Arts, and CyberTimes arts@large focus on the arts and humanities and provide fascinating glimpses into the worlds of dance, music, performance, cinema, and other topics pertaining to human's creative expression.

So brush up your knowledge of Shakespeare, grab a canvas, and put on your dancing shoes. The visual arts and literature Web sites on the Internet are about to sweep you off your cyber feet.

For more information on arts and literature Web sites, visit the Discovering Computers 2002 E-Revolution Web page (scsite.com/dc2002/e-rev.htm) and click Arts and Literature.

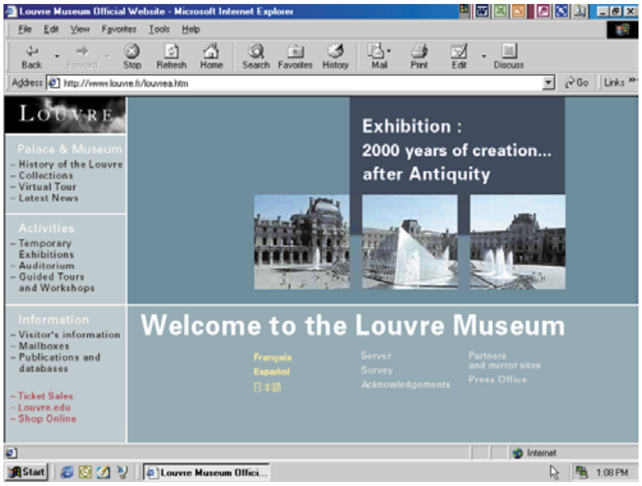

Louvre Museum Official Website - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss
Address http://www.louvre.fr/louvrea.htm
Go Links
LOUVRE
Palace & Museum
- History of the Louvre
- Collections
- Virtual Tour
- Latest News
Activities
- Temporary Exhibitions
- Auditorium
- Guided Tours and Workshops
Information
- Visitor's information
- Mailboxes
- Publications and databases
- Ticket Sales
- Louvre.edu
- Shop Online
Exhibition : 2000 years of creation... after Antiquity
Welcome to the Louvre Museum
Français
Español
日本語
Server
Survey
Acknowledgements
Partners and mirror sites
Press Office
Internet
Start
Louvre Museum Offici...
1:08 PM

Figure 16-37 Established in 1793 by the French Republic, the Louvre Museum is one of the earliest European museums. You can view its collections online.

ARTS AND LITERATURE WEB SITES	URL
Arts	
Absolutearts.com	absolutearts.com
Access Place Arts	accessplace.com/arts.htm
Argus Clearinghouse	clearinghouse.net/arthum.html
Cyber Times art@large	nytimes.com/library/tech/reference/index/artatlarge.html
Gallery Guide	galleryguide.org
J. Paul Getty Museum	www.getty.edu
Louvre Museum	www.louvre.fr
Montreal Museum of Fine Arts	www.mmfa.qc.ca
The Children's Museum of Indianapolis	childrensmuseum.org
Literature	
Bibliomania	www.bibliomania.com
Electronic Literature Directory	directory.eliterature.org
Fantastic Fiction	fantasticfiction.co.uk
Gale's Literary Index	www.galenet.com/servlet/LitIndex
Modern Library eBooks	randomhouse.com/modernlibrary/ebookslist.html
Project Gutenberg	promo.net/pg
Shakespeare.com	shakespeare.com

For an updated list of art and literature Web sites, visit scsite.com/dc2002/e-rev.htm.

Figure 16-38 Discover culture throughout the world by visiting these art and literature Web sites.

eREVOLUTION E-ARTS E-LITERATURE applied:

1. Visit the Modern Library eBooks Web site listed in Figure 16-38, and view one book in the 20th Century Novels, 19th Century Novels, British Literature, and History sections. Create a table with columns for the book name, author, cost, online store, local store, and description. Then, read the excerpt from each of the four books and write a paragraph describing which of these four books is the most interesting to you. What are the advantages and disadvantages of reading classic literature electronically?

2. Using the arts Web sites listed in Figure 16-38, search for three temporary exhibitions in galleries throughout the world. Describe the venues, the artists, and the works. What permanent collections are found in these museums? Some people shop for gifts in the museums' stores. View and describe three items for sale.

In Summary

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch16/summary.htm. Click the links for current and additional information. To listen to an audio version of this In Summary, click the Audio button. To play the audio, RealPlayer must be installed on your computer (download by clicking here).

1 What Are Some Careers Opportunities in the Computer Industry?

Job opportunities in the computer industry are found primarily in four areas – hardware, software, IT professionals, and training and education. In the computer hardware industry, jobs exist in manufacturing of computers, computer components, and peripherals. Career opportunities in the software industry involve designing and programming, including application software for business, productivity software, educational programs, entertainment software, and systems software. In many companies, IT professionals set up and manage the computer equipment and software. The IT professional may work in management, operations, system development, technical services, and end user computing. Companies and organizations that provide computer-related training and education also provide opportunities for teachers and trainers. Other IT careers include sales, service and repair, and consulting.

2 How Do You Prepare for a Career in the Computer Industry?

To prepare for a career in the computer industry, you first must decide on the area in which you are interested and then obtain education in that field. Begin your preparation by visiting professional organizations and job opportunity Web sites. After making your decision, you must choose a course of study. Three broad disciplines in higher education are **computer information technology**, **computer science**, and **computer engineering**. At the community college level, students can obtain an A.S. or an A.A.S degree. Trade schools are an alternative to enrolling in a college or university.

3 What Is Certification?

Certification demonstrates the mastery of a skill set and knowledge base in a specific IT area and ensures a level of competency, skills, or quality in a particular area. Certification can help companies ensure that their workforce remains current on computers and technology.

4 What Are the Different Types of IT Certification?

More than 200 certifications are available within the IT industry. Most of the certifications are developed by **sponsors**. Some certifications have a broad focus, while others require an in-depth knowledge. Some sponsors have a series of related certifications tied to different levels of expertise. Software application certifications include Microsoft Office Professional, Adobe Photoshop, Autodesk AutoCad, and Lotus Notes. Operating systems certifications focus on the user, the operator, the system administrator, and the system engineer. **Microsoft's MCP** and **MCSE** certifications demonstrate knowledge of Microsoft's operating systems. The **Red Hat Certified Engineer Program** (**RHCE**) validates mastery of the Linux operating system, while IBM certifications are UNIX oriented. Microsoft, Sun, and IBM offer certifications in the programming area. Several companies provide hardware certifications. One of the most popular is A+, provided by Computing Technology Industry (CompTIA), which also relates to network certification. A variety of network certifications are available, including Microsoft's MCSE, Cisco's CCIE and CCNP, and Novell's CNE. Several Internet certifications are available and include both hardware and software tracks. Within the database area, certifications are in hardware, Internet, networking, and programming.

5 What Are the Benefits of Certification?

Some of the benefits include proof of professional achievement, enhancement of job opportunities, salary increases, and opportunities for advancement. Vendor-sponsored certifications may provide special privileges, such as access to technical and product information or access to **beta products**. Vendors also benefit from the product recognition and support the certification brings.

6 What Are the Considerations for Choosing a Certification?

Selecting a certification is a personal process that requires careful thought and research. Consider your career goals and interest and then assess your background knowledge and expertise.

7 What Are the Methods of Preparation for Certification?

Test results determine certification. Most people follow a study program to prepare for the test. Training options include studying on your own with educational materials, taking online classes, or attending an instructor-led class, or using a combination of these options.

8 What Are the Features of Certification Examinations and Recertification Requirements?

Authorized testing companies provide most certification and recertification exams. At the testing centers, examinations are delivered via computer, and most tests are in a multiple-choice format. Some tests use the **computerized adaptive testing (CAT)** technique. Some training centers provide a program guarantee and offer discounts or free sessions for those individuals who complete the program, but do not pass the test.

9 How Do You Keep Informed about Changes in Certification?

To keep pace with the changes in information technology, professionals must maintain and continually monitor technological developments. Most certifications expire after a set time limit. If a product update is released, certificate holders must retrain almost immediately.

Key Terms

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch16/terms.htm. Scroll through the list of terms. Click a term to display its definition and a picture. Click the To WEB button for current and additional information about the term from the Web. To see animations, Shockwave and Flash Player must be installed on your computer (download by clicking here).

A+ certification (16.21)
Adobe Certified Expert (ACE) (16.18)
Application Developer, Oracle Developer Release 1 Track (16.24)
application programmer (16.9)
articulation agreement (16.13)
Associate and Senior Network Specialist Technician (NNT) (16.20)
Association for Computing Machinery (ACM) (16.14)
Association of Information Technology Professionals (16.14)
AutoCAD Certified Professional (ACP) (16.18)
beta products (16.26)
certification (16.16)
Certified Computing Professional (CCP) (16.19)
Certified Internet Professional (16.23)
Certified Internet WebMaster (CIW) (16.23)
Certified Java Developer (16.20)
Certified Java Programmer (16.20)
Certified Lotus Specialist (CLS) (16.18)
Certified Novell Associate (CNA) (16.22)
Certified Novell Engineer (CNE) (16.22)
Certified Sybase Professional – Database Administrator (CSP-DBA) (16.24)
Certified System Administrator (16.18)
Certified Web Professional (CWP) (16.23)
Cisco Certified Internetwork Expert (CCIE) (16.21, 16.22, 16.23)
Cisco Certified Network Professional (CCNP) (16.22)
COMDEX (16.14)
computer engineer (16.11)
computer engineering (CE) (16.13)
computer operator (16.9)
computer science (CS) (16.13)
computer science engineer/software engineer (16.9)
computer support specialist (16.11)
computer technician/computer service technician (16.9)
computerized adaptive testing (CAT) (16.30)
consultant (16.11)
data communications analyst (16.9)
database administrator (16.11)
database analyst/data modeler (16.9)
desktop publishing specialist (16.9, 16.11)
digital signal processor (DSP) designer (16.4)
graphic designer/illustrator (16.9)
help desk specialist (16.9)
IBM Certified Developer Associate (16.20)
IBM Certified Professional Server Specialists (PSS) (16.20)
IBM Certified Solutions Expert DB2 UDB V6.1 (16.24)
IBM Certified Specialist (16.18, 16.20)
IBM Database Administration for UNIX, Windows, and OS/2 (16.24)
Informix Certified Database Specialist (16.24)
integrated circuit (IC) designer (16.4)
MCSE + Internet (16.23)
Microsoft Certified Database Administrator (MCDBA) (16.24)
Microsoft Certified Professional (MCP) (16.18)
Microsoft Certified Solution Developer (MCSD) (16.20)
Microsoft Certified Systems Engineer (MCSE) (16.18, 16.19, 16.22)
Microsoft Office User Specialist (MOUS) (16.18, 16.19)
MIS director/CIO (16.9)
network (LAN) administrator (16.9)
Network + (16.22)
network security specialist (16.9)
programmer/analyst (16.5)
project engineer (16.6)
project leader (16.9)
project manager (16.7, 16.9)
quality assurance specialist (16.9)
Red Hat Certified Engineer (RHCE) (16.18)
software engineer (16.6)
software engineering (SE) (16.13)
Sun Certified Architect for JavaTechnology (16.20)
system programmer (16.9)
systems analyst (16.9, 16.11)
systems integrator (16.4)
technical writer (16.9)
user group (16.14)
Web administrator (16.7)
Web developer (16.7)
Web graphic designer (16.7)
Web programmer (16.7)
Webcaster (16.7)
Webmaster (16.7)
Windows 2000 MCSE (16.20)
wireless designer (16.4)

CERTIFICATION
A way for employers to ensure a level of competency, skills, or quality in a specific area. (16.16)

Learn It Online

Web Instructions: To display this page from the Web, start your browser, and then enter the URL scsite.com/dc2002/ch16/learn.htm.

1. Web Guide

Click Web Guide to display the Guide to World Wide Web Sites and Searching Techniques Web page. Click Reference and then click About.com. Search for electronic commerce. Click one of the electronic commerce links. Use your word processing program to prepare a brief report on your findings and submit your assignment to your instructor.

2. Scavenger Hunt

Click Scavenger Hunt. Print a copy of the Scavenger Hunt page; use this page to write down your answers as you search the Web. Submit your completed page to your instructor.

3. Who Wants to Be a Computer Genius?

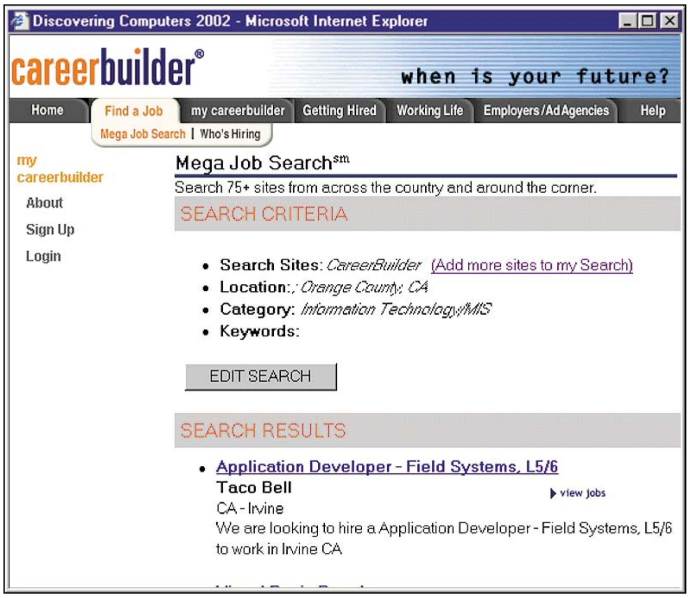
Click Computer Genius to find out if you are a computer genius. Directions on how to play the game will display. When you are ready to play, click the PLAY button. Submit your score to your instructor.

4. Wheel of Terms

Click Wheel of Terms to reinforce important terms you learned in this chapter by playing the Shelly Cashman Series version of this popular game. Directions on how to play the game will display. When you are ready to play, click the PLAY button. Submit your score to your instructor.

5. Career Corner

Click Career Corner to display the CareerBuilder Web site. Click the My Job link and search for an IT job. Scroll through the results until you find a job in which you are interested. Write a brief report on the job you selected and what you discovered. Submit the report to your instructor.



Mega Job Search℠

Search 75+ sites from across the country and around the corner.

SEARCH CRITERIA

- Search Sites: CareerBuilder (Add more sites to my Search)
- Location:; Orange County, CA
- Category: Information Technology/MIS
- Keywords:

SEARCH RESULTS

- Application Developer - Field Systems, L5/6
  Taco Bell
  CA - Irvine
  We are looking to hire a Application Developer - Field Systems, L5/6 to work in Irvine CA

6. Search Sleuth

Click Search Sleuth to learn search techniques that will help make you a research expert. Submit the completed assignment to your instructor.

7. Crossword Puzzle Challenge

Click Crossword Puzzle Challenge. Complete the puzzle to reinforce skills you learned in this chapter. Directions on how to play the game will display. When you are ready to play, click the PLAY button. Submit the completed puzzle to your instructor.

8. Practice Test

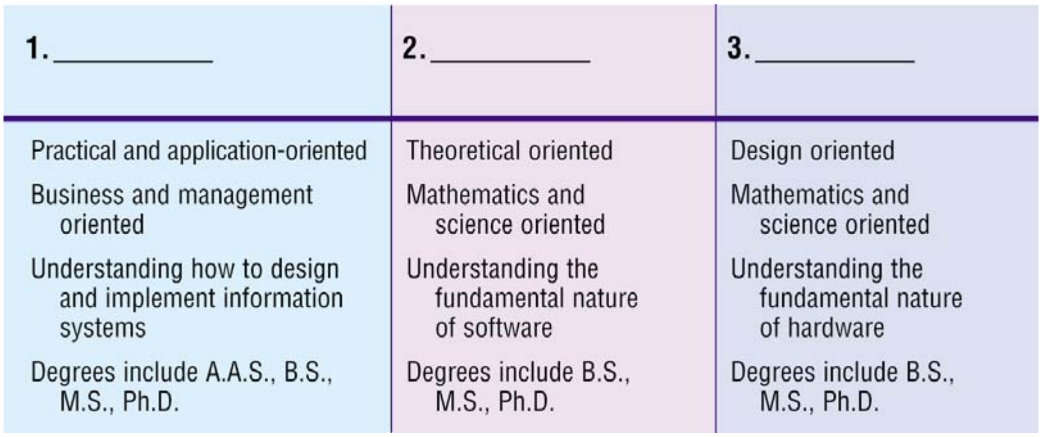
Click Practice Test. Answer each question. When completed, enter your name and click the Grade Test button to submit the quiz for grading. Make a note of any missed questions. If required, print a copy to submit to your instructor.

Checkpoint

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch16/check.htm. Click the links for current and additional information. To experience the animation and interactivity, Shockwave and Flash Player must be installed on your computer (download by clicking here.)

LABEL THE FIGURE

Instructions: Identify the different computer disciplines.



1.__________	2.__________	3.__________
Practical and application-oriented	Theoretical oriented	Design oriented
Business and management oriented	Mathematics and science oriented	Mathematics and science oriented
Understanding how to design and implement information systems	Understanding the fundamental nature of software	Understanding the fundamental nature of hardware
Degrees include A.A.S., B.S., M.S., Ph.D.	Degrees include B.S., M.S., Ph.D.	Degrees include B.S., M.S., Ph.D.

MATCHING

Instructions: Match each term from the column on the left with the best description from the column on the right.

_______ 1. sponsor
_______ 2. certification
_______ 3. beta products
_______ 4. computerized adaptive testing
_______ 5. Red Hat Certified Engineer program

a. Validates mastery of the Linux operating system.
b. A hardware certification.
c. Computer hardware and software vendors.
d. Validates mastery of Cisco networking.
e. Ensures a level of competency, skills, or quality in a particular area.
f. Products that are still in the testing stage.
g. Analyze a person's responses.

Checkpoint

MULTIPLE CHOICE

Instructions: Select the letter of the correct answer for each of the following questions.

1. An example of a hardware certification is ___________ .
   a. A+
   b. UNIX
   c. Java
   d. Oracle DBA
2. The most frequently encountered format for a certification examinion is ___________ .
   a. hands-on
   b. multiple-choice
   c. adaptive testing
   d. simulation
3. An office manager has excelled in word processing, spreadsheets, and desktop publishing. He would most likely be interested in a(n) ___________ certification.
   a. database
   b. operating system
   c. hardware
   d. software applications
4. Most people prefer to prepare for a certification exam by using ___________ as a training option.
   a. beta products
   b. computerized adaptive testing
   c. the H1B Visa program
   d. a combination of self-study, online, and instructor-led classes
5. ___________ companies manufacture and distribute computer systems and computer-related equipment.
   a. Hardware
   b. Software
   c. Networking
   d. Programming

SHORT ANSWER

Instructions: Write a brief answer to each of the following questions.

1. Job opportunities in the computer industry are found in what four areas? ___________ List some of the leading software companies offering certifications. ___________
2. Describe IT professionals. ___________ What are some IT career positions? ___________
3. What skills are necessary for a computer consultant? ___________ What are some tasks that a consultant may perform? ___________
4. What are the three computer disciplines within higher education? ___________ How are they different? ___________ What is the difference between and A.S. and an A.A.S. degree? ___________
5. What is a professional organization? ___________ How does involvement in a professional organization benefit computer professionals? ___________ List some of the more popular professional organizations. ___________

WORKING TOGETHER

Instructions: Working with a group of your classmates, complete the following team exercise.

Study options for obtaining certifications include self-study, online courses, and instructor-led courses. Use the Internet to find a Web site for self-study materials, a second for online training, a third for seminar-style instructor-led training, and a fourth Web site for academic-style instructor-led training. Select a common certification track available from each training center. Compare the training programs. Consider the number of classes required, the cost per class, and the duration of each class. Prepare a report and a PowerPoint presentation to share with your class.

In The Lab

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch16/lab.htm. Click the links for current and additional information.

Using the Character Map Utility

1

This exercise uses Windows 98 procedures. The Character Map Utility lets you retrieve characters for use in other programs. Click the Start button on the taskbar, point to Programs on the Start menu, point to Accessories on the Programs submenu, point to System Tools on the Accessories submenu, and then click Character Map. When the Character Map window opens, click a character of your choice, and then click the Select button. Click a second character and click the Select button a second time. Click the Copy button. Close the Character Map window by clicking its Close button. Click the Start button on the taskbar, point to Programs on the Start menu, point to Accessories on the Programs submenu, and then click Notepad on the Accessories submenu. Click Edit on the menu bar and then click Set Font. Click Symbol in the Font list. Click the OK button in the Font dialog box. Click Edit on the menu bar and then click Paste to paste the characters into the Notepad window. Press the ENTER key and type your name. Click File on the menu bar and then click Save. When the Save As dialog box displays, make sure you have a floppy disk in drive A and then type `a:\h16-1` in the File name text box. Click the Save button in the Save As dialog box. After saving, close the Notepad window.

Adding a Scrap to the Desktop

2

To keep the contents of the Clipboard on your desktop for later reference, you can create a scrap. The are two ways to create a scrap are: drag-and-drop and copy and paste. You can recognize a scrap by its icon — it looks like a document file, except for a torn edge along the bottom. Click the Start button on the taskbar, point to Programs on the Start menu, point to Accessories on the Programs submenu, and then click WordPad on the Accessories submenu. Type your name and address. To use drag-and-drop, select the text and drag it to the desktop to create a scrap. To use copy and paste, select the text and click Copy on the Edit menu. Right-click the desktop and then click Paste on the shortcut menu to create a scrap containing the information copied to the Clipboard. To use the scrap in a document, drag it into the document. Or, right-click the scrap, click Copy on the shortcut menu, and then paste it into your document. Close Notepad. Do not save the file. Delete the scrap on the desktop by dragging it to the Recycle Bin.

Toggle Keys

3

The Microsoft's Accessible options allow you to sound a beep when the CAPS LOCK key is engaged. Click the Start button, point to Settings, and click Control Panel on the Settings submenu. Double-click the Accessibility Options icon. If necessary, click the Keyboard tab and click the Use Toggle Keys check mbox. Click the OK button. Close the Control Panel window. Press the CAPS LOCK key to hear the sound. Press it again to disengage it. This option functions the same for the NUM LOCK and SCROLL LOCK keys. To return the Toggle Keys to their original settings, in the Control Panel window, click the Accessibility Options icon and deselect the Use Toggle Keys check box. Click the OK button, and then close the Control Panel window.

Disk Maintenance

4

This exercise uses Windows 98 procedures. Hard disk maintance should be done on a regular basis. To check when these operations were last performed, right-click the Start button on the taskbar and then click Explore. Right-click the (C:) icon, and then click Properties on the shortcut menu. When the (C:) Properties dialog box displays, click the Tools tab. The status of each of these operations displays. Answer the following questions:

- When was the last day the drive was checked for errors?
- How many days has it been since the files were backed up?
- How many days has it been since the disk was defragmented?

Close the (C:) Properties dialog box and the Exploring - Start Menu window.

Web Work

Web Instructions: To display this page from the Web, start your browser and enter the URL scsite.com/dc2002/ch16/web.htm. To view At The Movies in exercise 1, RealPlayer must be installed on your computer (download by clicking here).

Internet Economy

To view the Internet Economy movie, click the button to the left or click the Play button to the right. Watch the movie, and then complete the exercise by answering the questions below. Skyrocketing growth of the Internet has created a massive shortfall of qualified employees. College graduates with degrees in engineering or computer science, however, can expect at least a dozen job offers upon graduation. Internet employment lures job seekers with the dream of latching onto a winner and becoming quick millionaires before hitting age 30. At the same time, chaos and uncertainty prevail in the industry as thousands of companies go under. If you are looking for an Internet-related job, what are the things to look for in a company? Where do you look for Internet-related jobs? What skills are required?

Interviewing for an IT Career

Making a good impression and preparing for an interview is one of the more important steps to getting a job. To begin your preparation, compose a list of common questions that you may be asked. Most employers will ask about experience, qualifications, and future plans. Next, prepare a list of questions that you can ask your potential employer. Some common questions are about benefits, types of training programs, and available career paths. Then practice, practice, practice. One way to practice in a safe environment is through a virtual interview. Click the button to the left and complete the virtual interview. Was the interview helpful? What questions were the most difficult?

MOUS Certification

One of the more popular application certification programs is the Microsoft Office User Specialist (MOUS) certification. The certification program recognizes individuals who have achieved a certain level of mastery with Microsoft Office products and provides a framework for measuring end-user proficiency with the Microsoft Office applications. Attaining MOUS certification proves you have met an industry-recognized standard for measuring an individual's mastery of Office applications, demonstrates proficiency in a given Office application to employers, and provides a competitive edge in the job marketplace. Click the button to the left for a list of frequently asked questions (FAQs) about the MOUS program. Read the questions. What types of certifications are available? What kind of preparation is necessary for certification? Does your educational institution offer MOUS courses?

In the News

As the IT professionals shortage continues, several certification sponsors have started offering certification training and testing to high school students. The students choose computers as a major and take courses in certification programs such as A+ and MCSE. Many states have magnet schools where most of the curriculum is focused on technology. Click the button to the left and read a news article about a recent high school certification story. Could this trend cause a potential problem with students not attending college?

Figure 1
In the future, computers will have an even more important role in all aspects of your life by providing vast information resources, fast communications, and powerful support for activities in homes, schools, and businesses.

TRENDS 2002
A Look to the Future

WEB INSTRUCTIONS: *To gain World Wide Web access to additional and up-to-date information regarding this special feature, start your browser and enter the URL shown at the top of this page.*

Progress in computing no longer affects only computer scientists, engineers, and information technologists. Today, computer advances influence all individuals, families, organizations, and schools (Figure 1). As you have learned throughout this book, computers already are an essential part of people's daily lives; they quickly have become a mainstay, much as the automobile, television, and telephone have. In the future, computers will take on many new roles and become an even more pervasive and critical part of homes, schools, and businesses. This special feature looks at several computer technology trends that will influence the direction of the computer field and then looks at the impact those technologies will have on information technology in business.

TRENDS IN COMPUTER TECHNOLOGY

During the next several years, the greatest advances in computer technology will occur in areas such as hardware, software, communications and networks, mobile and wireless connectivity, and robotics.

Hardware

Manufacturers intensely are developing and producing new devices, including microdisplays and headsets, that will pervade all aspects of people's lives. This hardware will contain faster and smaller chips, which could be implanted in your body. Atomic Quantum computers and optical computers could process data at record-breaking speeds. Fluorescent multiplayer discs and digital books will revolutionize the ways information is stored and accessed. These hardware developments will affect learning and playing.

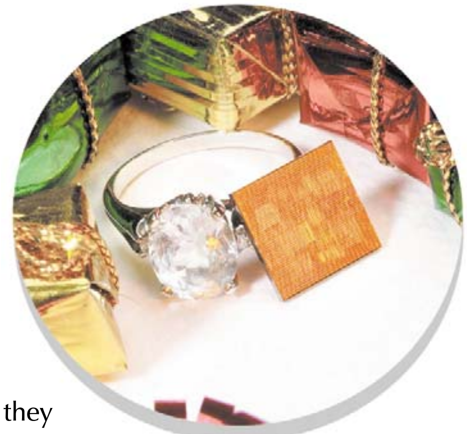


Figure 2
IBM's custom processor built with new technology contains circuits as small as 0.13 of a micron, or nearly 800 times thinner than a human hair. The smaller circuitry and improved materials can pack more processing power on a single chip.

UBIQUITOUS COMPUTING Computers are not yet everywhere, but as they get smaller, faster, and less expensive, they are being utilized in everything from toothbrushes and curling irons to cars and spaceships. Ralph Merkle, a research scientist at Xerox's Palo Alto Research Center, envisions a "not-so-distant future, maybe by 2020, definitely by 2050, [in which] we will have devices with the computational power of . . . roughly a billion Pentium computers." Having access to such enormous computational power will change the emphasis of computing from processing data to generating information to managing knowledge. Further, every device known to man, including the human body, will use some type of computer to help it function more efficiently and effectively.

NEXT-GENERATION CHIP Engineers are using extreme ultraviolet lithography (UVL) to turn their circuit designs into silicon chips. This technology uses ultrasmooth mirrors, rather than optical projection, to draw circuits that are 100 times more powerful than today's chips. Intel's Pentium® 4 processors run at speeds of 1.4 GHz and higher and contain 42 million transistors that are 0.13 of a micron wide. A micron is the width of a human hair (Figure 2). By 2005, chip manufacturers plan to introduce chips that will run at speeds up to 10 GHz with 400 million transistors that are just 0.03 of a micron wide. When the circuits are closer together, data travels shorter distances and consequently requires less time to process. Intel's 64-bit Itanium processor also will improve the speed of high-end workstations and servers.

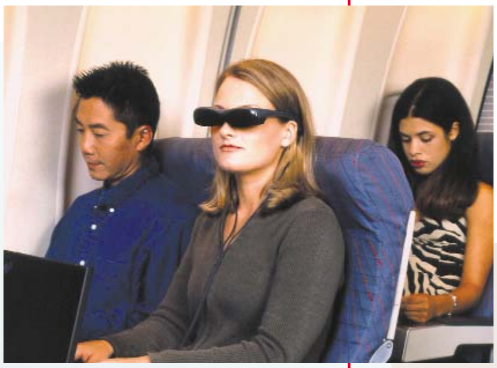


Figure 3
Video and television images will appear right before your eyes with new visual appliances.

MICRODISPLAYS AND HEADSETS You will be seeing technology in a whole new way with the advent of visual devices that resemble sunglasses. One model replicates a 52-inch television screen or Sony PlayStation 2 on an LCD screen (Figure 3). Headsets plug into DVD players, notebook computers, desktop computers, and digital cameras and allow a display measuring one-tenth of an inch to look like a full-sized theater screen. Microdisplays the size of postage stamps fill your field of vision and appear as large as a regular monitor when magnified (Figure 4).

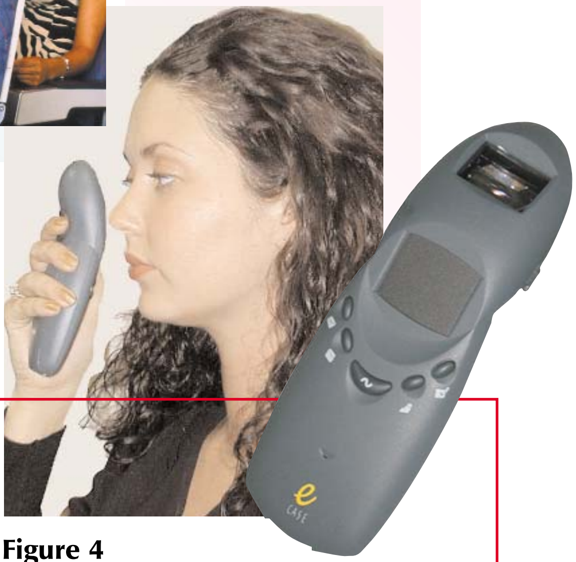


Figure 4
Microdisplays give you the visual equivalent of a 19-inch monitor and allow you to view Web pages, e-mail, maps, and calendars.

HUMAN COMPUTER INTEGRATION Some researchers believe the processor eventually will become an integral part of the most complex device known — the human body. Computers already are used inside the human body. Cochlear implants, for example, help some deaf people hear by stimulating the ear and the nerves that send information to the brain. The next step in human computer integration will involve implanting chips in the body to help it

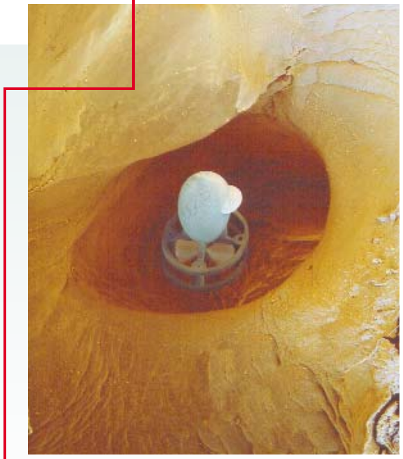


Figure 5
Doctors hope to use a microsubmarine to detect and repair defects in the human body. This device measures four millimeters in length and 0.65 millimeter in diameter.

perform basic functions (Figure 5). A processor, for example, could help regulate the release of hormones in the same way that a processor regulates the fuel mixture in modern autos.

Canadian futurist Frank Ogden has conceived an even more futuristic use of embedded processors, called CyberSight. With CyberSight, a processor interfaces with a person's optic nerve to allow him or her to see information transmitted over a wireless link. The CyberSight system, for example, could transmit the floor plans of a building to a firefighter; the plans then would display in the vision of the firefighter, so that he or she can determine the best way to enter a burning building.

ATOMIC QUANTUM COMPUTERS By the middle of this century, the computer on your desk could very well be filled with liquid instead of transistors and chips. It probably will be called a QC for Quantum computer, rather than a personal computer. In theory, the speed of Quantum computers could be up to a billion times faster than today's fastest Pentium® 4 computers. At that speed, a Quantum computer could search the entire Internet instantaneously or break any security code in a second. Quantum computers use quantum mechanics, rather than digital technology. In a Quantum computer, bits are replaced by atoms. Several computer companies, the federal government, and a number of independent research teams are working feverishly to put the theory of quantum computing into practice.

OPTICAL COMPUTERS Transmitting data using optical technology has become commonplace in CD-ROM drives, laser printers, photocopiers, and scanners and in fiber optic digital communications. Some engineers believe this technology will extend to computers using visible light or infrared beams to perform digital computations, increasing the speed of operations tenfold. Likewise, it should decrease the optical computers' physical size because the light beams can pass through each other without interacting.

Figure 6
Demand is expected to increase for electronic books (e-books). Some of these devices can hold up to 56,000 pages, or the equivalent of 150 books' worth of text.

FLUORESCENT MULTILAYER DISC (FMD) The next step in storage capacity is the Fluorescent Multilayer Disc. The first generation of this five-inch clear optical medium can hold 140 GB of data — almost 30 times more than a DVD-ROM disc can store. Data is recorded on fluorescent materials, which reflect light, on the disc's multiple layers. These discs could have as many as 100 layers of data, which will increase their storage capacity to one terabyte (one trillion bytes). Uses include high-definition television, digital cinema, and mobile applications, such as digital cameras. FMD-ROM drives currently are read-only, but engineers are perfecting recordable FMD technology.

DIGITAL BOOKS The Internet clearly will have a major impact on libraries. During this decade, many libraries will convert hard copy documents into digital form. Eventually, this could develop into online universal libraries to which all schools have access. While looking for a book in this online universal library, you could search a network of individual online libraries to find the book, view any checkout terms or fees, and then view or download it from the library Web site. Traditional libraries, however, still will exist, if only to house publicly accessible computers and a collection of books required to verify digitized versions.

Initial consumer reluctance for the electronic book, or e-book, is expected to subside in the next few years. Several companies have introduced these small book-sized computers (Figure 6) that can hold up to 56,000 pages, or about 150 books' worth of text. By pressing a button, you can move forward or backward through the text. You also can download Web pages and add notes or highlight text using a small pen input device. Although the tablet-sized displays will not have the clear resolution of ink on a page for years to come, Microsoft has developed ClearType, which significantly enhances the appearance of the font on a screen.

EDUCATION The use of personal computers in educational settings is another rapidly growing area. The Internet and the World Wide Web are affecting education, as distance education allows students to take classes or Webinars — online seminars — whenever they have time from home or workplace computers. Such courses are ideal for workers seeking advanced training but lacking the time to pursue on-campus studies or for undergraduates living far from campus. University professors will continue to develop entire courses using video lectures with coordinated demonstrations on virtual blackboards — all distributed to students over the Internet. Critics argue, however, that while the Internet can help with continuing education and professional retraining initiatives, a fully Internet-based education cannot capture the full value of the educational experience.

Imagine learning a new subject without ever going to class or opening a book. A further phase of human computer integration could involve making various disciplines such as mathematics, literature, and foreign languages available on processors. If you wanted to learn Dutch, you could purchase a chip from a local retail store, much as you purchase a CD. Once you upload the chip to your brain through an implanted port, immediately you will know Dutch — without ever taking a class. While this may seem farfetched, recent advances suggest it is possible.

ENTERTAINMENT For the younger members of the family, playing games using entertainment software always has had a large appeal. Many adults, however, find that entertainment software also provides them with hours of enjoyment. Popular types of entertainment software include arcade games, board games, and simulations.

Entertainment software also consists of a variety of interactive adventure games, which range from rescuing a princess from a castle's dungeon to solving a murder mystery. You can play many of these games in groups using a network or on the World Wide Web, or you can play with just the computer as your opponent. Entertainment software usually allows players to adjust the level of play to match their abilities — that is, beginner through advanced. With entertainment software, the computer becomes a fun, skillful, and challenging game partner.

Sega Corporation is developing an assortment of games to play on Motorola's new application-upgradable handsets. UIEvolution is working on interactive games, starting with chess, checkers, hangman, and Space Invaders, that allow users to play between multiple wireless handsets.

Virtual reality (VR) is the use of computers to simulate a real or imagined environment that appears as a three-dimensional (3-D) space. VR allows you to explore and manipulate controls to experience the 3-D space completely (Figure 7). One futurist suggests that VR someday will allow moviegoers to pretend they are one of the movie characters. In such an environment, the virtual reality technology would link the moviegoer's sensory system (sight, smell, hearing, taste, and touch) to the character's sensory system.

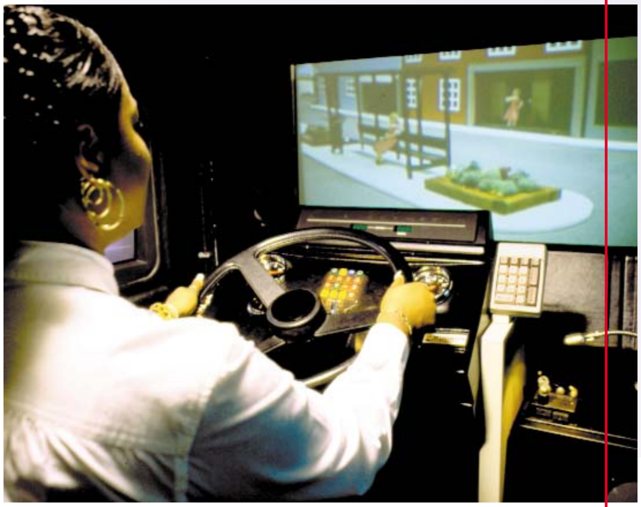


Figure 7
New Jersey bus driver trainees learn to maneuver their vehicles on virtual streets. New Jersey Transit says the virtual training saves the company thousands of dollars each year in training costs and also reduces accidents.

Software

A second major area of technology innovation involves the instructions that tell computers what tasks to perform. Software trends include improved user interfaces, enhanced Internet content, digital music, MP4 video compression, intelligent agents, speech recognition, and remote control of home appliances.

USER INTERFACE Most computers use a graphical user interface (GUI), which developers have dubbed the WIMP (windows, icons, menus, and pointer) interface. To use the WIMP interface, you must learn a new mode of communication that includes pointing, clicking, dragging, and so on. Next-generation operating systems will be more natural and human-centric, meaning they will allow you to interface with a computer using many of the methods you now use to communicate with humans. Such methods will include natural language, hand gestures, facial expressions, and of course, spoken words.

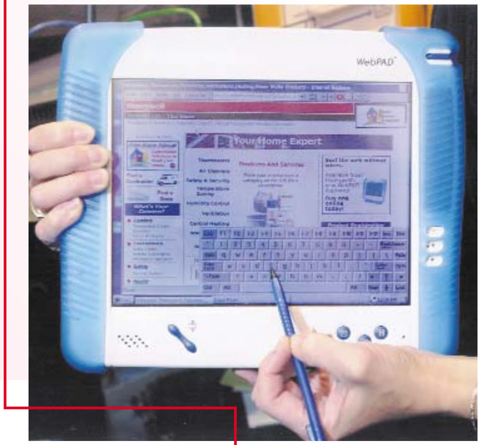


Figure 8
Web tablets offer consumers easy access to browsers and Web sites.

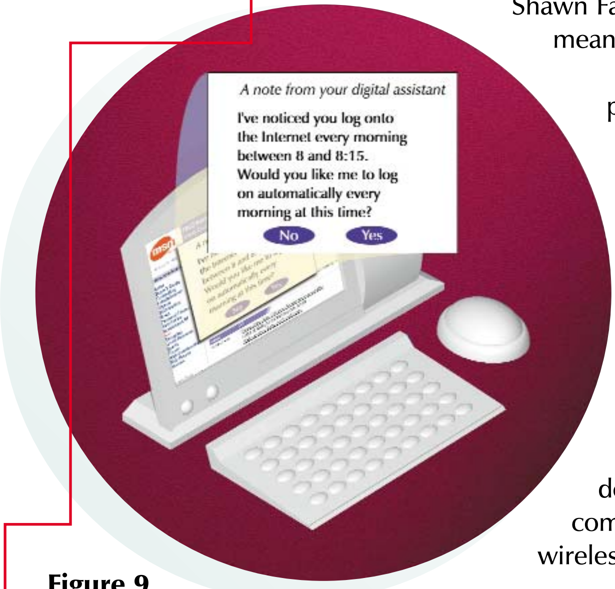
THE INTERNET AND THE WEB In this decade, the Internet and the Web promise many exciting developments. Already, the Internet is the fastest growing segment of the computer industry and is a major reason why consumers are buying personal computers and handheld devices at a record pace. Today, one half of U.S. homes have access to the Internet. At present, individuals primarily use the Internet to access information and communicate using e-mail. In the future, individuals increasingly will rely on two other Internet-based communication applications — telephony and videoconferencing.

Other developments will be Web tablets (Figure 8), which feature full-color touch screens allowing users easy access to the Internet, and the continued integration of television, networks, and computers. For now, the relatively inexpensive WebTV allows you to send e-mail and surf the Web using your television set. In the future, you will use WebTV in an interactive fashion to view your favorite movie, television show, concert, sporting event, or shopping guide.

MUSIC AND THE INTERNET As more digital music becomes available for download from the Internet, market analysts predict fewer consumers will buy CDs and will instead turn to MP3 and other digital audio players. MP3 technology compresses audio files, so music can be downloaded from Web pages and transmitted in e-mail messages much faster than with uncompressed files. Sales of players using this technology have soared from $126 million in 1999 to an expected $1.25 billion by the end of 2002. This growth is due, in part, to Shawn Fanning and his Napster software and company, which were created as a means of allowing music lovers to swap songs.

Legal proceedings for copyright infringement against Napster and its progeny helped spur consumer awareness that high-quality music is available on the Internet, and many musicians have released songs solely on the Web. Sony and many other entertainment companies are pursuing selling music via Internet-based pay-per-listen systems. Some analysts predict one-third of all consumers will have virtual music collections by 2005.

MP4 VIDEO COMPRESSION Video files can be compressed to 10 percent of their original size with MP4 technology, which filters out images the eye cannot perceive. Using today's standards, a full-length compressed video would take two hours to download, but as broadband Internet access and data transfer rates increase, the download time should become more manageable. Entertainment companies are considering sending movie trailers and video messages on wireless handheld devices.


A note from your digital assistant

I've noticed you log onto the Internet every morning between 8 and 8:15. Would you like me to log on automatically every morning at this time?

Figure 9
Intelligent agents are programs with built-in intelligence that monitors a user's work patterns and carry out tasks independently.

INTELLIGENT AGENTS For more than 40 years, artificial intelligence (AI) experts promoted the advantages of smart software — that is, software with built-in intelligence. In recent years, as this concept has become reality, the term, intelligent agent, has evolved to describe any software program that independently asks questions, pays attention to work patterns, and carries out tasks on behalf of a user (Figure 9).

Some intelligent agents are embedded and work within a single program. Other intelligent agents, sometimes called network agents, perform tasks on multiple remote computers with different platforms before bringing the results back to the user. Intelligent agents already are a part of several productivity software packages. Some e-mail software, for example, includes intelligent agents that allow individuals and businesses to filter incoming messages and request immediate notification of messages about specific subjects or from specific individuals. The Intellisense™ technology built into Microsoft Office also is based on an intelligent agent.

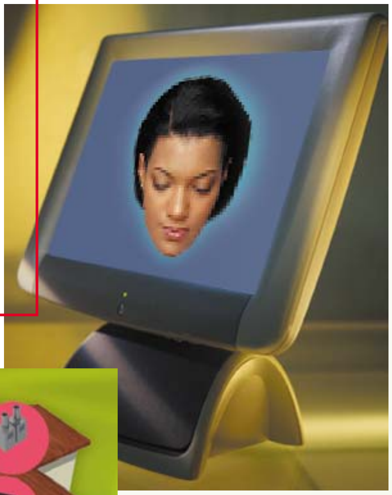
SPEECH RECOGNITION The ability to understand a natural language means that a computer will be capable of translating your spoken statements into computer instructions and responding in an appropriate fashion. The market for voice recognition software is expected to climb to $22.6 billion in 2003, up from $356 million in 1997. The newest version of Microsoft Office includes Office Speech Recognition software, which allows you to speak the names of menu commands, toolbar buttons, dialog box controls, text, and numbers. You also can instruct the computer to read a document or worksheet to you in a male or female voice. In the near future, computers will support continuous-speech voice recognition and use artificial intelligence to determine the meaning of your spoken words.

In an even more advanced use of speech recognition, computers will recognize your voice commands and respond in a computer-generated voice through an on-screen presence that resembles a person, animal, or other object. IBM and Apple, for example, have developed prototype interfaces that resemble the human head (Figure 10). When using this interface, you turn off the computer by telling the character to go to sleep. The character closes its eyes and droops its head as the computer begins to shut down.

CONTROL OF HOME SYSTEMS The smart home of the future will include appliances that plug into the Internet (Figure 11). Electronics retailers will feature integrated systems to network your computer, television, security system, heating and air conditioning units, stove, refrigerator, DVD, VCR, video games, and monitoring devices. You then will be able to use a telephone or computer to change the operation of one of the control systems, such as turning lights on or off or viewing the contents of your storeroom by using a Web cam.

Smart appliances using the Sun Microsystems Java and Jini technologies can perform time-consuming chores. For example, your refrigerator or pantry will be linked through a home control system to the grocery store and order groceries without your intervention. Modern refrigerators will have Web panels that display recipes and then convert the recipes' ingredients to shopping lists, which can be forwarded to a handheld computer, mobile telephone, or online shopping service, such as Webvan (Figure 12). Dishwashers will communicate with their manufacturers to report malfunctions or maintenance problems and then be repaired remotely (Figure 13). Coffeemakers will download new functions as they become available. Entertainment media will download movies, games, music, and a week's worth of your favorite television programs from your cable company, satellite operator, or other video service.

Figure 10
Companies have prototype interfaces that resemble the human head to make voice recognition more realistic.



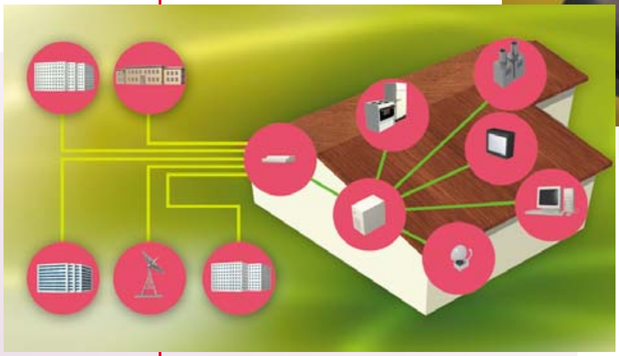
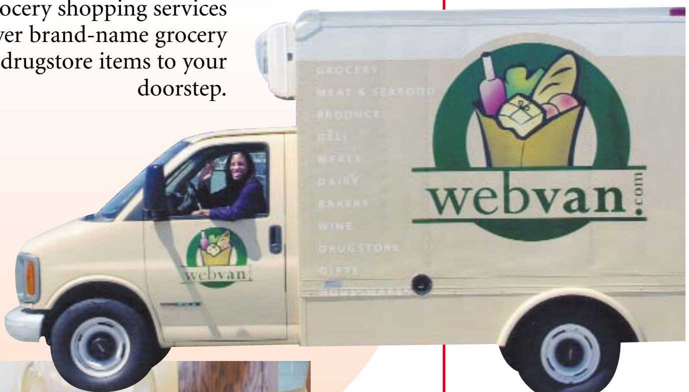


Figure 11
An integrated home network connects personal computers, security systems, heating and air conditioning, entertainment systems, lights, sprinkler systems, and smart appliances.

Figure 12
Grocery shopping services deliver brand-name grocery and drugstore items to your doorstep.



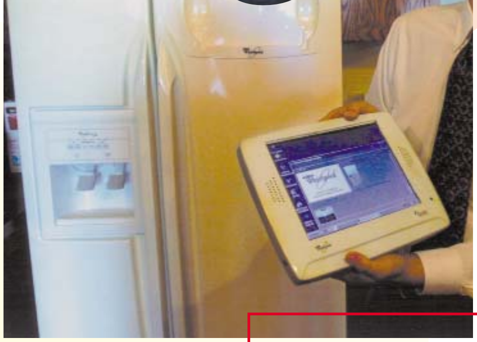


Figure 13
Smart homes feature appliances that communicate with manufacturers and let you connect to the Internet for news, recipes, and cooking information.

Communications and Networks

The methods of transmitting and sharing data are about to change dramatically. Updates include Microsoft's .NET strategy, home wireless networks, wired broadband, wireless communication, the Bluetooth™ standard, mobile Internet access, global positioning systems, electronic paper and ink, and multiple-function telephones.

.NET AND SOFTWARE SUBSCRIPTIONS Microsoft's .NET strategy is a new environment for developing and running software applications. .NET will provide instant access to data and services in the context of your current task. Microsoft plans to shift the focus of software from the desktop to Web-based services. As part of its Office Online initiative, the company has granted permission to more than 20 application service providers to host Microsoft Office applications. A .NET version of Office is slated for a 2003 release.

HOME WIRELESS NETWORKS Most technology companies are taking sides and backing one of two competing wireless standards for the home, but others are backing both. Apple Computer, Dell Computer, Sony, 3Com, and 70 other companies are supporting the Wi-Fi, or 802.11B, standard, while Intel, Motorola, Hewlett-Packard, and 80 other corporations are backing the alternate HomeRF standard. IBM and other companies are backing both, reluctant to be caught with obsolete equipment. The battle for dominance likely is to continue as new Net appliances and wireless devices emerge, data transfer rates increase, and prices drop.

WIRED BROADBAND During the next few years, home and business users can expect much faster access to the Internet as cable and telephone companies provide broader bandwidth. As discussed in Chapter 9, bandwidth is a measure of the amount of data a communications channel can transmit over a given period of time. The key to speeding up Internet access is to increase the bandwidth of the communications channel between the user and the access provider. For most users, this part of the communications channel, which is called the last mile, often involves using a modem to dial up and connect to a server over slow analog telephone lines. Several cable and telephone companies are increasing the bandwidth of the last mile by using fiber optics, broadband cable (TV cable), and fast Digital Subscriber Lines (DSL). Higher-bandwidth communications channels will eliminate the use of dial-up modem connections and greatly increase Internet access speeds for streaming video, interactivity, and real-time applications.

Figure 14
Wireless desktop connections will become commonplace in the next few years.

Figure 15
Wireless Internet connections will boost sales of handheld computers, particularly with expansion port add-ons such as keyboards, GPS modules, and bar code scanners.

Mobile and Wireless Connectivity

As the personal-computing market matures, consumers are looking for new ways to access the Internet and to communicate. Cordless products are in high demand, and these devices with Bluetooth™ technology should flood the market in the next few years. Third-generation communications service will increase Internet services. Other advances will be made in global positioning systems, electronic paper and ink, and multiple-function telephones.

WIRELESS DEVICES Recent advances in digital wireless technology have focused on using mobile telephones and handheld computers and devices. During the next few years, as these wireless forms of communication become the norm, attention will turn towards developing cordless computers (Figure 14) and other household appliances. Palmtops are expected to be the top-selling wireless devices (Figure 15) with an average annual growth of 28 percent through 2004. Palm, Inc., continues to dominate the wireless market, but products from Handspring and from companies using the Windows CE operating system will continue to erode Palm's market share.

BLUETOOTH™ Bluetooth™ technology allows cellular telephones, pagers, handheld computers and devices, and other wireless products to detect one another and communicate across short distances, usually a maximum of 30 feet. According to Cahners In-Stat Group, a leading industry analyst firm, manufactures should ship more than 1.4 billion Bluetooth™-enabled devices by 2005. The Bluetooth Special Interest Group (SIG) developers from the computing, networking, and telecommunications fields jointly are planning a wide range of applications, such as those that allow travelers to receive flight information automatically at airports or to be directed to the nearest coffee shop as they walk down a street. Shoppers with Bluetooth™-enabled cellular telephones could receive coupons as they walk past displays. Developers state this technology ultimately should add no more than $5 to the price of a chip.

MOBILE INTERNET ACCESS Japan's pioneer mobile-Internet company, NTT DoCoMo, Inc., plans to lead the world's new phase of broadband services, Wideband Code Division Multiple Access (W-CDMA). This third-generation (3G) mobile communications service has the data-transmission capacity to download songs and short video clips. Each day, more than 50,000 new Japanese consumers subscribe to DoCoMo's mobile Internet service, i-mode (Figure 16), which provides access to thousands of official i-mode and independent news services, information, and entertainment, as well as such specialized services as airline reservations, online shopping and banking, and the ability to exchange digital images. In contrast, American consumers have been reluctant to subscribe to mobile services that offer shopping, weather updates, and e-mail. DoCoMo has invested $9.8 billion in AT&T's wireless unit, representing a venture to close the gap between wireless technologies in the two countries.

Figure 16
NTT DoCoMo's i-mode mobile Internet service is immensely popular among Japanese consumers.

GLOBAL POSITIONING SYSTEMS The U.S. Department of Defense developed the Global Positioning System (GPS) for national security, but today this technology is found 10 times more frequently in civilian, rather than military, applications. The already widespread use of GPS devices is about to increase dramatically in 2002 when cellular telephone companies will be able to locate the position of their callers to within 100 meters and when localized wireless advertising is available. Cellular telephones may contain GPS technology that can be used on a pay-per-use basis. Designed to be implanted in the human body, the Digital Angel's wearable patch (Figure 17) will send and receive GPS information along with medical diagnostic data. In another use, a wind-up generator may provide the power for recreational GPS users who travel without power, such as hikers, bikers, and kayakers.

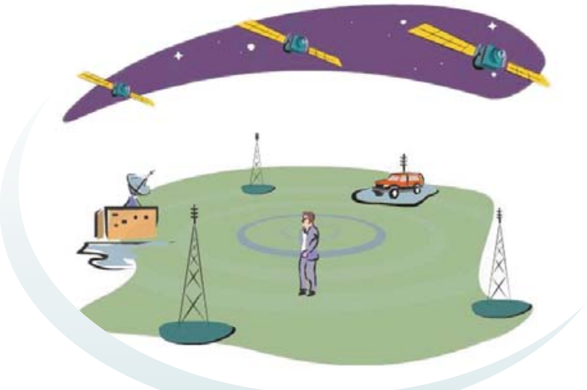
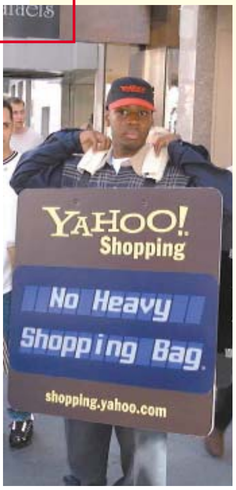


Figure 17
The Digital Angel provides location and monitoring information. Its microchip includes biosensors that measure body parameters and an antenna that communicates with GPS satellites.

ELECTRONIC PAPER/ELECTRONIC INK Engineers are developing electronic paper and ink products (Figure 18) that combine the strengths of digital technology with the qualities of paper, including its light weight and high contrast. Several companies are developing this rewriteable medium. Some use microscopic liquid particles or beads that are white on one side and black or red on the other and are suspended in a transparent plastic cavity. This display screen currently is as thick as a mouse pad, but eventually it will become as thin as four sheets of paper. The particles or beads respond to electronic impulses and move depending on the images requested. The next generation of e-paper will add organic light-emitting diodes (OLEDs) to the plastic sheets to display full color and full-motion video.

Figure 18
Electronic paper and ink products can be used for commercial displays. The messages can be changed by remote control.



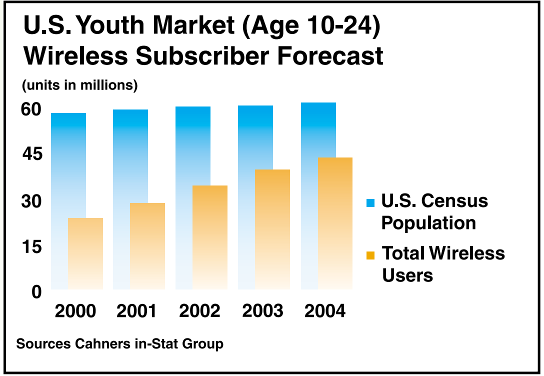


Figure 19
(Source: Cahners In-Stat Group) Cellular telephone manufacturers and carriers are aiming to lure young users to their products.

MULTIPLE-FUNCTION TELEPHONES Cellular telephones will be packed with new features. Some will be popular among young users — those between the ages of 10 and 24 — who are the target group for the newest products (Figure 19). The fastest growing cellular telephone application is e-mail messaging. Nearly every digital wireless telephone sold will feature this two-way text messaging, which allows users to type short messages into their telephones and then transmit the words to other wireless telephones. This service is very popular in Asia and Europe, especially in countries that do not have reliable or easily accessible wired telephone service. More than 10 billion text messages are sent each month. A joint venture between Ericsson and Microsoft should offer improved e-mail services on cellular telephones.

More people worldwide will be accessing the Internet via cellular telephones rather than by personal computers in 2003, according to industry executives. Fourth generation (4G) wireless standards are predicted to be in place by 2010, and they will offer even faster mobile Internet access.

Robotics

Computers capable of performing human tasks will be seen everywhere from hospitals to your home. Medical breakthroughs achieved in hospitals include brain pacemaker implants and distance surgery. Homes are becoming lively and clean with the advent of robots for entertainment and vacuuming.

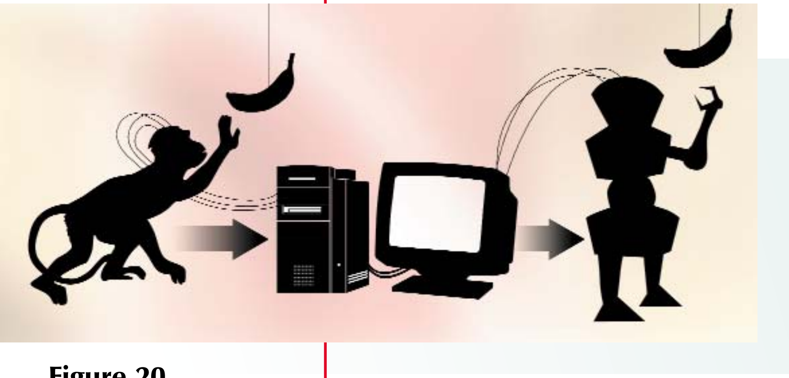


Figure 20
Research involing monkeys is helping researchers record brain cell activity. When the monkeys perform a learned task, their neurons generate brain waves that are transmitted to computers via wires implanted in the monkeys' brains. The computer decodes and sends the data to a robot that replicates the monkey's movements.

BRAIN PACEMAKER Scientists working with monkeys and studying how brain cells interact are perfecting a type of pacemaker to implant in the brain and send brain waves directly to a robot or device (Figure 20). One practical use is for reading the brain waves of people with seizure disorders, anticipating a seizure, and delivering drugs or electrical impulses that can stop or prevent a seizure.

DISTANCE SURGERY The next generation of health care will promote the use of robots to perform surgeries (Figure 21). The robots' precise skills and small sizes — less than one-fifth the size of traditional instruments — make surgeries less invasive and recovery times less prolonged. Surgeons view three-dimensional images of internal organs on large monitors and can control the robots' actions through voice commands.

Operating rooms will undergo another dramatic change when surgeons practice telemedicine. Through the use of videoconferencing and satellites, doctors can perform surgery when they are in locations other than the operating room.

Figure 21
Robot-aided surgeries help surgeons remove brain tumors. Information regarding the precise location of the tumor displays on the monitor and is fed into the robot's computer. Robotic surgeries result in minimal damage to the surrounding brain tissue.

AIBO Now you can have mankind's best friend without the mess and expensive veterinarian bills. Sony Corporation's AIBO (Artificial Intelligence Robot), which coincidentally is the Japanese word for companion, is a breed of entertainment robot with voice recognition technology, emotions, instincts, the ability to learn 50 verbal commands, and four senses for touch, hearing, sight, and balance (Figure 22). AIBO is part of Sony's development efforts to create robots that coexist with people and create unlimited opportunities for humans to interact with computers.

CYE-SR You will not have to worry about AIBO shedding its fur around your house, but this problem is a given with a real dog. Why not let a robot clean your room? Just use your personal computer to program the Cye-SR robot that is attached to the Probotics cordless vacuum cleaner (Figure 23). Cye-SR will travel throughout your house in search of dust and dirt.

Figure 22
Each AIBO develops an individual personality based on its interaction with its environment.

THE FUTURE OF INFORMATION SYSTEMS IN BUSINESS

Although millions of homes now include one or more computers, businesses by far are the largest users of computers. Around the world, organizations install and use millions of computers of all types — mainframes, personal computers, and more — for applications such as inventory control, billing, and accounting. These computers often are part of a large information system that includes data, people, procedures, hardware, and software.

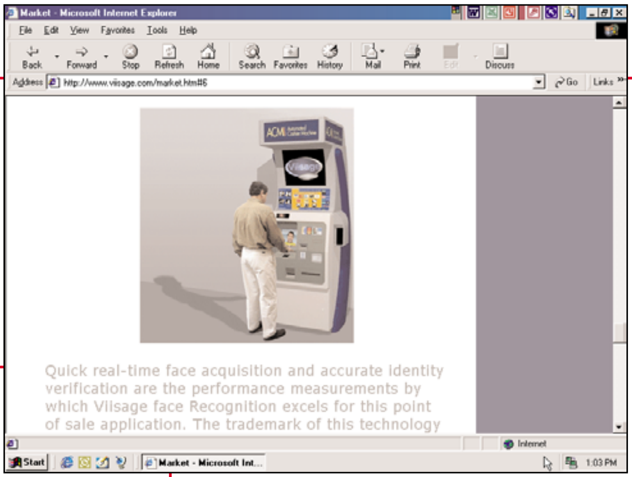
Existing business information systems will undergo profound changes as a result of the computer trends just described. As computers become increasingly ubiquitous and technologies converge, businesses will rely on computers for communications — and users at all levels will need to be computer literate. These new technologies will enhance security measures, provide computers for all employees, improve communications and health care in hospitals, and shape t-commerce and e-business.

Figure 23
The Probotics cordless vacuum cleaner comes with an added feature — the Cye-SR robot that scouts out dust.

AUTHENTICATION/SECURITY Public surveillance by businesses, government, and institutions is a growing industry, spurred by smaller and less expensive technology. According to the Security Industry Association, nearly $2 billion has been spent on computer controlled closed-circuit television networks, such as those being used in more than 60 U.S. cities to curb vandalism, prevent crime, and record incidents.

Surveillance is being taken to a higher level with software that converts images of faces to a series of 14 reference points, such as the eyebrows' bone structure and the distance between the eyes. This data is stored in databases and compared at rates of 45 million records per minute to people who pass by security cameras at countries' border crossings and who apply for new driver's licenses.

Upcoming software can be trained to recognize threatening behavior, such as when someone points a gun, and then alert the police. Applications also could help maintain security at automatic teller machines, where cardholders' facial images could be stored in a database and compared to a person using the machine (Figure 24). Computers also will use video cameras to record and identify individuals



Quick real-time face acquisition and accurate identity verification are the performance measurements by which Viisage face Recognition excels for this point of sale application. The trademark of this technology

Figure 24
Instead of entering a PIN, automatic teller machine users can access their accounts securely using face recognition to verify their identities.

through facial expressions and fingerprint recognition (Figure 25). Industry experts project that surveillance cameras could become so prevalent that everyone could watch everyone at any time.

WIRING THE ENTIRE WORKFORCE For many years, computer use centered around white-collar professionals sitting at desks using wired computers. Indeed, of all employees, nearly 70 percent uses some type of computer during the workday. With the influx of wireless products, manufacturers are striving to wire the other 30 percent of workers holding mobile positions, such as mechanics, inspectors, messengers, and warehouse workers, so they can send and retrieve detailed information while keeping their hands free for other tasks. The Palm OS® and Windows® CE platforms are opening opportunities for the blue-collar world, as are hardware and software advances in speech recognition, wireless headsets, and wearable computers equipped with processing power equal to that of desktop computers.

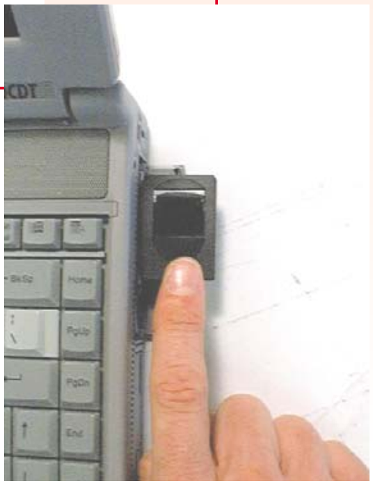
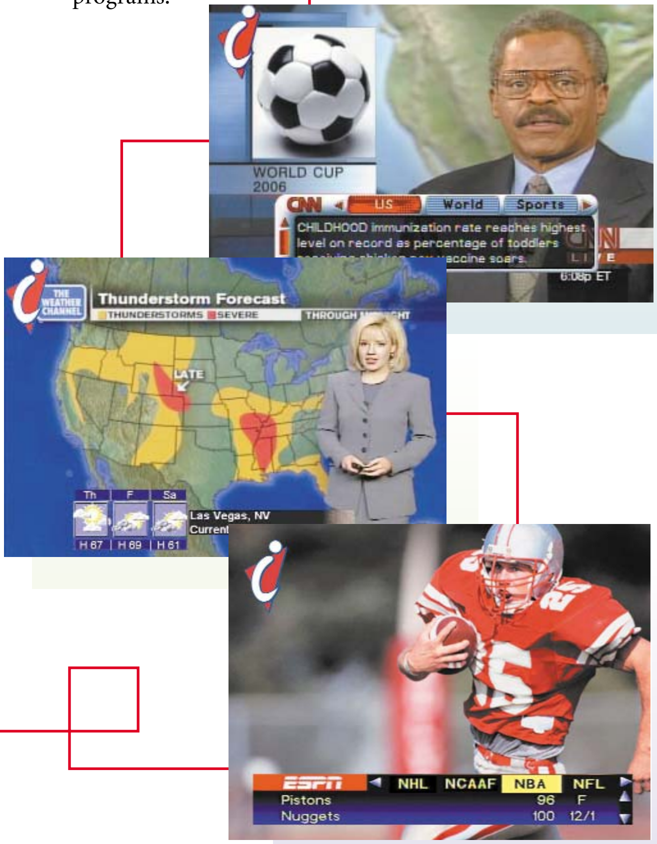


Figure 25
A fingerprint reader captures the curves and indentations of a fingerprint.

HEALTH-CARE INDUSTRY The medical industry has been recognized, in general, as being one of the last fields to integrate the Internet and high-tech solutions. Recent cuts in insurance reimbursements and federal Medicare spending have decreased revenues, resulting in budget cutting measures. Many health facilities, however, are integrating online medical-records systems, electronic medical charts, and medical literature searches. Wireless products will help improve patient care and communications; for example, some emergency room personnel use Palm handheld computers to access patients' medical records.

T-COMMERCE Television advertising is taking a new turn with the advent of t-commerce. Instead of buying commercial time, advertisers embed their ads in actual television programs (Figure 26). Viewers use their remote controls to interact with the television programs and advertisements by replying to free offers, buying items, receiving sports scores, and participating in games. The Wink service is featured on CNN, The Weather Channel, ESPN, and "The Tonight Show with Jay Leno." This form of advertisement can be termed merchantainment – a combination of merchandising and entertainment.

Figure 26
Wink Communications uses t-commerce in a variety of television programs.



E-BUSINESS The volatile e-commerce marketplace has produced some winners and many losers. In 2000, more than one dot-com (Internet-only) company failed each day. Companies with greater successes were those with both Internet and physical presences, known as clicks-and-mortar businesses. Each year, individual and business consumers purchase more goods and services online; approximately 50 percent of Web users shop online, and the same percent of investors trade securities online. During the next few years, more e-commerce applications — and the technologies used to support them — will be developed. Many of these technologies will be focused on improving the security of and expediting credit card transactions.

FEATURE SUMMARY

Despite the surge in dot-com failures and employee layoffs in early 2001, the demand for high-tech workers continues to be extremely strong. According to the U.S. Department of Labor, more than 5.6 million new software engineers, Web programmers, optical networking specialists, programmers, and systems analysts will be needed by 2006. Indeed, amazing opportunities increase daily in the ubiquitous computer technology industry.